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MINUTES OF PROCEEDINGS

OF

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CIVIL ENGINEERS.

SUBJECT INDEX:

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SESSIONS 1879–80 TO 1893–94.

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PREFACE.

THIS Index deals with the sixty octavo volumes of Minutes of Proceedings relating to the fifteen sessions from 1879–80 to 1893–94, both inclusive. It has been compiled on the same system as the preceding Index issued in 1881, to which it may be regarded as a continuation, and hence the general remarks then made will equally apply now. Thus, being a purely Subject-matter Index, the names of the Authors of Papers and of those taking part in the discussions, either orally or in writing, have been treated as subordinate. It is essentially analytical, and the alphabetical arrangement has been combined with a certain amount of classification, thereby affording facility for consultation, by which it is hoped any given subject of inquiry may be reached with the least expenditure of time and trouble. General references and historical notices are first disposed of, and then particular branches of the subject are taken up. Each large subject is sub-divided under leading headings, in each of which the main subject is repeated. In this way extensive sub-division has been practised where needful, whilst the main subject is, by repetition, kept steadily before the eye. It will be seen that, during the period covered by this Index, attention has been directed to: 1st. the primary object for which the Institution was founded, "the Advancement of Mechanical Science," in its many branches and developments, including "the art of navigation by artificial power" and "the construction and adaptation of machinery;" 2ndly. Works of Civil Construction and of the materials and

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plant employed in their execution, such as Aqueducts, Breakwaters, Bridges, Canals, Docks, Harbours, Lighthouses, Railways and Tramways, Tunnels, Rivers and Estuaries; 3rdly. Mining Operations and Appliances, the Extraction of Metals from their Ores, and especially the Metallurgy of Iron and Steel; 4thly. Rainfall and Evaporation as affecting the Supply of Water to Cities and Towns, with details of the construction of Waterworks and Reservoir Dams; likewise of "the Drainage of Cities and Towns" embracing considerations as to Sewerage and Sewage-Disposal Works; and 5thly. the various Applications of Electricity for Lighting, Power and other purposes. Where it appeared necessary, the entries have been repeated under different headings, but where there were numerous references which might have been placed under the same heading, the use of cross-references has been freely adopted, so as to comprehend as far as possible every matter of engineering interest that has arisen either in the Papers or in the discussions.

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A. Allgemeines.

I. Statistik.

1. Production der Bergwerke in Deutschland im Jahre 1881.

	Steinkohlen.		Braunkohlen.		Steinsalz.		Kalisalze.	
	Menge 1000 Tonnen.	Wert 1000 Mark.	Menge 1000 Tonnen.	Wert 1000 Mark.	Menge 1000 Tonnen.	Wert 1000 Mark.	Menge 1000 Tonnen.	Wert 1000 Mark.
1	2	3	4	5	6	7	8	9
Prov. Brandenburg	—	—	1 777,6	4 273	—	—	—	—
„ Posen	—	—	28,6	104	50,9	453	—	—
„ Schlesien ..	13 110,8	58 878	434,4	1 495	—	—	—	—
„ Sachsen ...	29,7	273	7 798,6	24 051	153,5	773	545,4	5 683
„ Hannover ..	438,8	2 870	0,4	2	—	—	—	—
„ Westfalen ..	15 813,5	72 763	—	—	—	—	—	—
„ Hessen-Nassau ...	108,9	965	179,0	860	—	—	—	—
„ Rheinland ..	14 278,8	81 225	193,6	484	—	—	—	—
Hohenzollern ...	—	—	—	—	3,3	13	—	—
Königreich Preussen	43 780,5	216 974	10 412,2	31 269	207,8	1 239	545,4	5 683
Bayern	519,6	4 442	18,1	67	0,9	22	—	—
Sachsen	3 707,8	25 664	600,7	1 899	—	—	—	—
Württemberg ...	—	—	—	—	84,2	597	—	—
Baden	9,4	91	—	—	—	—	—	—
Hessen	—	—	30,7	238	—	—	—	—
Mecklenburg	—	—	12,3	46	—	—	—	—
Thüringen	0,9	9	735,3	1 350	—	—	—	—
Braunschweig ...	—	—	273,7	892	—	—	—	—
Anhalt	—	—	766,1	2 350	19,0	103	360,5	3 690
Schaumburg-Lippe	108,9	965	—	—	—	—	—	—
Elsass-Lothringen.	560,9	4 107	3,2	11	—	—	—	—
Deutsches Reich .	48 688,2	252 252	12 852,3	38 122	311,9	1 961	905,9	9 373

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	Eisenerze.		Zinkerze.		Bleierze.		Kupfererze.	
	Menge 1000 Tonnen.	Wert 1000 Mark.	Menge 1000 Tonnen.	Wert 1000 Mark.	Menge 1000 Tonnen.	Wert 1000 Mark.	Menge 1000 Tonnen.	Wert 1000 Mark.
1	2	3	4	5	6	7	8	9
Prov. Schlesien . .	764,5	2 653	553,5	6 146	21,1	3 092	7,6	53
„ Sachsen . . .	55,9	240	—	—	—	—	445,4	13 210
„ Hannover . .	391,6	1 006	5,7	329	42,6	3 978	19,6	597
„ Westfalen . .	1 018,6	8 844	30,3	871	8,7	1 442	44,9	218
„ Hessen-Nassau . . .	628,8	3 859	13,3	492	21,2	2 032	1,6	54
„ Rheinland . .	1 046,9	9 821	56,4	1 739	65,9	7 906	4,9	195
Königr. Preussen .	3 906,3	26 423	659,2	9 577	159,7	18 450	523,6	14 327
Bayern	75,6	361	—	—	0,8	80	0,0	1
Sachsen	23,6	270	—	—	1,7	287	0,1	2
Württemberg . . .	19,3	154	—	—	—	—	—	—
Baden	—	—	0,3	17	—	—	—	—
Hessen	133,6	856	—	—	—	—	—	—
Thüringen	28,4	156	—	—	—	—	0,0	0
Braunschweig . . .	96,4	332	—	—	0,2	260	—	—
Anhalt	—	—	—	—	1,4	153	—	—
Waldeck	32,3	165	—	—	—	—	—	—
Elsass-Lothringen.	1 096,0	2 374	—	—	0,3	10	—	—
Deutsches Reich .	5 411,9	31 091	659,5	9 594	164,8	19 240	523,7	14 330
Hierzu Luxemburg	2 161,9	4 994	—	—	—	—	—	—
Zusammen . . .	7 573,8	36 085	659,5	9 594	164,8	19 240	523,7	14 330

	Silber- u. Golderze.		Schwefelkies und sonstige Vitriol- und Alaunerze.		Andere Bergwerksprodukte.		Summe aller Bergwerksprodukte.	
Prov. Brandenburg	—	—	—	—	—	—	1 777,6	4 273
„ Posen	—	—	—	—	—	—	79,5	557
„ Schlesien . .	—	—	11,1	122	0,4	27	14 903,4	72 466
„ Sachsen . . .	—	—	16,6	25	2,6	76	9 048,0	44 331
„ Hannover . .	0,1	118	0,1	2	18,9	631	918,2	9 533
„ Westfalen . .	—	—	107,5	1 068	0,1	11	17 023,6	85 217
„ Hessen-Nassau . . .	—	—	0,0	0	7,6	216	960,0	8 478
„ Rheinland . .	—	—	6,5	87	3,4	98	15 656,4	101 555
Hohenzollern . . .	—	—	—	—	—	—	3,3	13
Königr. Preussen .	0,1	118	142,0	1 304	33,2	1 059	60 370,0	326 423
Bayern	—	—	1,1	13	1,5	138	617,8	5 124
Sachsen	26,7	4 157	0,1	1	1,2	777	4 362,1	33 057
Württemberg . . .	—	—	0,1	1	—	—	103,6	752
Baden	—	—	—	—	0,0	2	9,7	110
Hessen	—	—	—	—	0,6	21	165,1	1 115
Mecklenburg	—	—	—	—	—	—	12,3	46
Thüringen	—	—	0,4	2	1,4	109	766,4	1 626
Braunschweig . . .	—	—	—	—	18,0	94	389,0	1 578
Anhalt	—	—	—	—	2,1	48	1 149,1	6 344
Schaumburg-Lippe	—	—	—	—	—	—	108,9	965
Waldeck	—	—	—	—	0,0	5	32,3	170
Elsass-Lothringen.	—	—	2,4	8	9,7	180	1 672,5	6 690
Deutsches Reich .	26,8	4 275	146,1	1 329	67,7	2 433	69 758,8	384 000
Hierzu Luxemburg	—	—	—	—	—	—	2 161,9	4 994
Zusammen . . .	26,8	4 275	146,1	1 329	67,7	24 33	71 920,7	388 994

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2. Gewinnung von Salzen aus wässriger Lösung in Deutschland während des Jahres 1881.

	Kochsalz.		Chlorkalium.		Andere Salze.		Summe aller Salze.	
	Menge 1000 Tonnen.	Wert 1000 Mark.	Menge 1000 Tonnen.	Wert 1000 Mark.	Menge 1000 Tonnen.	Wert 1000 Mark.	Menge 1000 Tonnen.	Wert 1000 Mark.
1	2	3	4	5	6	7	8	9
Prov. Posen	20,7	522	—	—	—	—	20,7	522
„ Schlesien ..	—	—	—	—	9,9	710	9,9	710
„ Sachsen ...	110,5	2 620	51,3	6 656	24,5	624	186,3	9 900
„ Hannover ..	83,3	1 992	0,1	5	5,5	266	88,9	2 263
„ Westfalen ..	23,5	711	—	—	2,4	300	25,9	1 011
„ Hessen-Nassau ...	3,7	108	—	—	12,9	500	16,6	6 608
„ Rheinland ..	4,2	80	—	—	19,9	2 431	24,1	2 511
Hohenzollern ...	1,9	63	—	—	—	—	1,9	63
Königr. Preussen .	247,8	6 096	51,4	6 661	75,1	4 831	374,3	17 588
Bayern	44,4	1 961	—	—	4,4	581	48,8	2 542
Sachsen	—	—	—	—	6,9	558	6,9	558
Württemberg....	27,8	920	—	—	0,0	2	27,8	922
Baden	30,7	925	—	—	1,5	105	32,2	1 030
Hessen	14,8	352	—	—	0,4	65	15,2	417
Mecklenburg	1,6	41	—	—	—	—	1,6	41
Thüringen	33,9	839	—	—	—	—	33,9	839
Braunschweig ...	7,6	171	—	—	—	—	7,6	171
Anhalt.....	—	—	61,8	7 429	33,7	908	95,5	8 337
Lippe	1,4	50	—	—	—	—	1,4	50
Elsass-Lothringen	47,0	948	—	—	0,8	124	47,8	1 072
Deutsches Reich .	457,0	12 303	113,2	14 090	122,8	7 174	693,0	33 567

3. Hüttenproduction in Deutschland im Jahre 1881.

	Roheisen						Zink.	
	überhaupt		darunter: Masseln		darunter: Gusswaaren 1 er Schmelzung			
	Menge 1000 Tonnen.	Wert 1000 Mark.	Menge 1000 Tonnen.	Wert 1000 Mark.	Menge 1000 Tonnen.	Wert 1000 Mark.	Menge 1000 Tonnen.	Wert 1000 Mark.
1	2	3	4	5	6	7	8	9
Prov. Schlesien ..	331,8	18 656	329,1	18 360	1,8	258	67,6	20 200
„ Sachsen ...	—	—	—	—	—	—	—	—
„ Hannover ..	144,5	7 539	143,9	7 436	0,5	95	—	—
„ Westfalen ..	647,5	38 589	643,0	38 136	3,2	379	11,7	3 564
„ Hessen-Nassau ...	31,7	3 153	18,9	1 522	9,1	1 394	—	—
„ Rheinland ..	1 017,9	62 961	1 002,3	61 509	11,5	1 279	26,1	7 848
Königr. Preussen .	2 172,9	130 898	2 137,2	126 963	26,1	3 405	105,4	31 612
Bayern.....	39,1	2 244	36,6	1 874	1,8	324	—	—
Sachsen	9,8	665	9,8	665	—	—	0,1	42
Württemberg ...	9,5	1 236	2,0	206	4,5	777	—	—
Hessen	34,9	2 622	34,7	2 601	0,1	14	—	—
Thüringen	25,6	1 662	25,6	1 662	—	—	—	—
Braunschweig ...	21,4	1 572	19,0	1 220	1,5	294	—	—
Elsass-Lothringen.	307,2	11 767	304,2	11 642	0,6	63	—	—
Deutsches Reich .	2 620,4	152 666	2 569,1	146 833	34,6	4 877	105,5	31 654
Hierzu Luxemburg	293,6	11 309	293,6	11 309	—	—	—	—
Zusammen ...	2 914,0	163 975	2 862,7	158 142	34,6	4 877	105,5	31 654

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	Blei (einschl. Kaufglätte)		Kupfer (einschl. Schwarzkupfer u. Kupferstein).		Silber.		Gold.	
	Menge 1000 Tonnen.	Wert 1000 Mark.	Menge 1000 Tonnen.	Wert 1000 Mark.	Menge 1000 Tonnen.	Wert 1000 Mark.	Menge 1000 Tonnen.	Wert 1000 Mark.
1	2	3	4	5	6	7	8	9
Prov. Brandenburg	0,9	3	0,0	25	0,2	27	6	17
„ Schlesien . .	16,0	4 428	0,2	121	9,6	1 476	—	—
„ Sachsen . . .	—	—	11,0	14 483	59,6	9 149	—	—
„ Hannover . .	9,4	2 618	0,2	73	26,4	4 055	39	108
„ Westfalen . .	2,9	793	2,0	2 662	2,5	376	—	—
„ Hessen-Nassau . .	9,2	2 561	0,3	168	12,9	1 934	153	425
Rheinland	46,2	12 783	1,8	1 795	31,7	4 756	—	—
Königr. Preussen.	83,7	23 186	15,5	19 327	143,1	21 773	198	550
Sachsen	4,9	1 384	—	—	39,1	5 993	159	446
Braunschweig . . .	2,0	512	0,4	576	3,8	395	24	67
Anhalt	0,8	156	—	—	1,0	153	—	—
Deutsches Reich .	91,2	25 238	15,9	19 903	187,0	28 514	381	1 063

	Zinn.		Sonstige Metalle.		Andere Hütten-producte.		Summe aller Hütten-producte.	
Prov. Ostpreussen .	—	—	—	—	1,2	49	1,2	49
„ Westpreussen	—	—	—	—	1,3	52	1,3	52
Stadt Berlin	—	—	—	—	4,9	271	4,9	271
Prov. Brandenburg	—	—	0,2	117	4,1	319	4,3	508
„ Posen	—	—	—	—	2,0	160	2,0	160
„ Schlesien . .	—	—	0,0	85	37,5	2 559	452,6	47 525
„ Sachsen . . .	—	—	—	—	35,9	1 680	47,0	25 312
„ Hannover . .	—	—	—	—	11,4	988	165,5	15 381
„ Westfalen . .	—	—	0,1	443	24,6	1 341	688,8	47 768
„ Hessen-Nassau . . .	—	—	0,0	17	21,2	1 149	62,4	9 407
„ Rheinland . .	—	—	—	—	49,2	2 963	1 141,2	93 106
Königr. Preussen .	—	—	0,3	662	193,3	11 531	2 571,2	239 539
Bayern	—	—	—	—	2,1	194	41,2	2 438
Sachsen	106,4	243	0,1	1 196	17,9	2 991	33,0	12 960
Württemberg . . .	—	—	—	—	0,1	5	9,6	1 241
Baden	—	—	—	—	9,5	350	9,5	350
Hessen	—	—	—	—	7,0	280	41,9	2 902
Thüringen	—	—	—	—	6,2	199	31,8	1 861
Braunschweig . . .	—	—	—	—	15,3	1 434	39,1	4 756
Anhalt	—	—	—	—	—	—	0,8	309
Hamburg	—	—	—	—	17,4	900	17,4	900
Elsass-Lothringen .	—	—	—	—	8,2	287	315,4	12 054
Deutsches Reich .	106,4	243	0,4	1 858	277,0	18 171	3 110,7	279 310
Hierzu Luxemburg	—	—	—	—	—	—	293,6	11 309
Zusammen . . .	106,4	243	0,4	1 858	277,0	18 171	3 404,3	290 619

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Vorläufiges Ergebnis der Berufszählung vom 5. Juni 1882 im deutschen Reich in Bezug auf die chemische Industrie.

Bei der Aufarbeitung des Materials der am 5. Juni 1882 erfolgten Berufszählung wurden in jedem Beruf die darin ermittelten Erwerbsthätigen eingeteilt in:

a) Selbständige, einschliesslich leitende Beamte und sonstige Geschäftsleiter. Dazu gehören: Die Eigentümer, Inhaber, Besitzer, Mitinhaber oder Mitbesitzer (Compagnons), Pächter, Handwerksmeister, Directoren, Administratoren und geschäftsleitenden Verwalter;

b) Höheres Verwaltungs-, Aufsichts- sowie das Rechnungs- und Bureau-Personal. Hierzu sind gezählt die nicht geschäftsleitenden Verwalter und sonstigen nicht geschäftsleitenden Beamten, überhaupt das wissenschaftlich, technisch und kaufmännisch gebildete Verwaltungs- und Aufsichtspersonal, Procuristen, Disponenten, Buchhalter, Rechnungsführer, Geschäfts- und Handlungsreisende, sowie die im Betriebe beschäftigten Rechner, Schreiber u. s. w.

c) Sonstige Gehilfen und Arbeiter. Diese Berufsstellung umfasst alle anderen in dem Berufszweig thätigen Personen, einschliesslich der Aufseher, Vorarbeiter, Werkmeister etc., sowie die in entsprechender Stellung im Beruf des Familienhauptes thätigen Familienglieder.

Die chemische Industrie umfasst nach der Classification folgende Berufsarten:

1. Chemische, pharmaceutische und photographische Präparate.
2. Apotheker.
3. Farbematerialien mit Einschluss von Tierkohle und Kohlenfilter, Steinkohlenteer und Kohlenteer-Derivaten.
4. Explosivstoffe und Zündwaaren.
5. Abfälle und künstliche Düngstoffe.
6. Abdecker.

1. Chemische, pharmaceutische und photographische Apparate.

(Hierzu sind gezählt: Aetherfabrikanten und Verfertiger ätherischer Producte, Aetznatronfabriken, Alaunhütten, Albuminfabrikanten, Alkaliwerke, Alkaloidfabriken, Ammoniakbereiter, Antichlorfabrikanten, Aschensieder, Balsamfabriken, Benzoinsäurefabrikanten, Blancfixefabriken, Bleiweissfabrikanten, Bleizuckerfabrikanten, Blutlaugensalzfabrikanten, Bluttrocknungsanstalten, Brompräparateverfertiger, Chemiker, Chemische Fabriken, Fabrikanten chemischer Präparate, Chininfabriken, Chloralhydratfabriken, Chlorkaliumfabrikanten, Chlorkalkfabrikanten, Chloroformfabriken, Collodiumfabrikanten, Droguenbereiter, Eisenvitriolfabriken, Holzdestillateure, Holzessigfabriken, Insectenpulverfabriken, Jodpräparateverfertiger, Kalisalzfabriken, Fabrikanten von Kesselsteinlösungsmitteln, Kupfervitriolfabriken, Latwergenverfertiger, Laugenmacher, Melissenpillenfabrikanten, Oelgeistfabrikanten, Oxalsäurefabriken,

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Phosphorfabriken, Fabriken für Photographiebedarf, Pillenfabriken, Potaschsieder, Präparirer von pharmaceutischen Waaren, Pulverisiranstalten, Pyrogallussäurefabriken, Quecksilberabzieher, Betriebsstätten für Quecksilberpräparate, Salpeterfabriken, Salpeter- und Salzsäurefabriken, Schwefelkohlenstofffabriken, Schwefelsäurefabriken, Schwefel- und Schwefelblumefabriken, Schwefelzieher, Sodafabrikanten, Sulfatfabriken, Fabriken für Verbandstoffe, Vitriolhütten, Vitriolölhütten, Waldwollfabriken, Wasserglasfabriken, Weinsteinfabriken.)

Die Zahl der Erwerbsthätigen betrug 18 606 und zwar 17 811 = 95·7 Proc. männlichen, 795 = 4·3 Proc. weiblichen Geschlechts.

Nach der Stellung im Beruf verteilen sich diese Erwerbsthätigen wie folgt:

	männlich	weiblich	zusammen
a) Selbständige	1 453	34	1 487
b) Verwaltungs- und Aufsichtspersonal	1 377	17	1 394
c) sonstige Gehilfen und Arbeiter . .	14 981	744	15 725

d. i. in Procenten der Erwerbsthätigen bei a = 8·0 Proc., bei b = 7·0 Proc. bei c = 84·5 Proc.

Mit ihren häuslichen Dienstboten und Angehörigen sind diese Erwerbsthätigen mit folgenden absoluten und Procentzahlen vertreten: bei a 5 732 = 9·8 Proc., bei b 3 406 = 5·9 Proc., bei c 49 338 = 84·3 Proc., in Summa 58 476 Erwerbsthätige, Dienende und Angehörige.

482 Personen anderer Berufe, und zwar 459 männlichen und 23 weiblichen Geschlechts, waren nebensächlich bei der Anfertigung chemischer etc. Präparate thätig, so dass unter Hinzurechnung dieser im Ganzen 18 270 männliche und 818 weibliche, zusammen 19 088 Personen in dieser Berufsart beschäftigt waren.

2. Apotheker.

12 450 Personen, und zwar 12 158 = 97·7 Proc. männliche, 292 = 2·3 Proc. weibliche, waren hier erwerbsthätig und verteilten sich ihrer Stellung im Beruf nach folgender Art:

	männlich	weiblich	zusammen
a) Selbständige	4 663	166	4 829
b) Verwaltungs- und Aufsichtspersonal .	2 010	6	2 016
c) sonstige Gehilfen und Arbeiter . . .	5 485	120	5 605

d. i. in Procenten der Erwerbsthätigen bei a = 38·8 Proc., bei b = 16·2 Proc., bei c = 45·0 Proc.

Mit ihren häuslichen Dienstboten und Angehörigen sind diese Erwerbsthätigen mit folgenden absoluten und Procentzahlen vertreten: bei a 23 458 = 69·9 Proc., bei b 2 551 = 7·6 Proc, bei c 7 533 = 22·5 Proc. in Summa 33 542 Erwerbsthätige, Dienende und Angehörige.

Die Zahl der Personen anderer Berufe, welche nebensächlich in Apotheken beschäftigt waren, ist auf 176, und zwar 155 männliche, 21 weibliche, angegeben, so dass die Gesamtzahl der Personen in diesem Beruf sich auf 12 313 männliche, 313 weibliche, zusammen 12 626 bezifferte.

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3. Farbematerialien mit Einschluss von Tierkohle und Kohlenfilter, Steinkohlenteer- und Kohlenteer-Derivaten.

(Dazu gehören: Alizarinfabrikanten, Anilinfabrikanten, Anilinfarbenfabrikanten, Anthracen- und Anthracenfarbenfabrikanten, Beinschwarzfabrikanten, Benzinfabrikanten, Benzolfabrikanten, Bleistiftfabrikanten, Brocatfarbenfabrikanten, Broncefarbenfabrikanten, Carbolsäurefabrikanten, Cochenillefarbenfabrikanten, Corallinfabrikanten, Desinfectionspulverfabrikanten, Dintefabrikanten, Emaillefabrikanten, Erdfarbenfabrikanten, Farbenfabrikanten, Farbenbereiter, Farbholzextractfabrikanten, Farbholzmüller, Farbholzraspler, Farbmüller, Garancinefabrikanten, Glasfarbenfabrikanten, Glimmerfarbenfabrikanten, Grünspanfabrikanten, Knochenbrenner, Kohlenfabriken für physikalische Zwecke, Kohlenfilterfabriken, Kohlenstaubfabriken, Kohlenteerdestillation, Kohlenteerfarbenfabriken, Krappmühlen und Betriebsstätten für Krappräparate, Kreidebereiter, Kreidefabrikanten, Mirbanölfabriken, Naphtalinfabriken, Pastellstiftfabrikanten, Pikrinsäurefabriken, Betriebsstätten für plastische Kohle, Porzellanfarbenfabriken, Rötemüller, Schwärzmüller, Schwarzballfabrikanten, Spodiumfabriken, Tierkohlefabriken, Ultramarinfabriken, Zeichnungskreidemacher, Zinnoberfabriken.)

Die Erwerbsthätigen in diesem Beruf beziffern sich auf 10506 Personen, wovon 9159 = 87·2 Proc. männlichen und 1347 = 12·8 Proc. weiblichen Geschlechts waren, die sich der Stellung im Beruf nach folgender Art verteilen.

	männlich	weiblich	zusammen
a) Selbständige	702	112	814
b) Verwaltungs- und Aufsichtspersonal .	697	3	700
c) sonstige Gehilfen und Arbeiter . . .	7760	1232	8992

d. i. in Procenten der Erwerbsthätigen bei a = 7·7 Proc., bei b = 6·7 Proc., bei c = 85·6 Proc.

Mit ihren häuslichen Dienstboten und Angehörigen sind diese Erwerbsthätigen mit folgenden absoluten und Procentzahlen vertreten: bei a 3390 = 11·2 Proc., bei b 1812 = 6·0 Proc., bei c 24951 = 82·8 Proc., in Summa 30153 Erwerbsthätige, Dienende und Angehörige.

Nebensächlich waren 361 Personen, und zwar 329 männliche, 32 weibliche, anderer Berufsarten bei der Herstellung von Farbematerialien etc. thätig, und es beziffert sich unter Hinzurechnung derselben die Gesamtzahl der Personen, welche diesen Beruf als Haupt- oder Nebenberuf ausüben, auf 10867, wovon 9488 männlichen und 1379 weiblichen Geschlechts waren.

4. Explosivstoffe und Zündwaaren.

(Hierzu sind gerechnet: Dynamitfabrikanten, Explosivstofffabrikanten, Feuerwerker, Feuerwerksfabrikanten, Feuerwerkskörperverfertiger, Feuerzeugfabrikanten, Kunstfeuerwerker, Munitionsartikelfabrikanten, Nitroglycerinfabrikanten, Patronenfabrikanten, Pikratpulverfabriken, Pulverfabrikanten, Schiessbaumwollefabriken, Schiesspulverfabriken, Schwamm- (Zündschwamm-) Fabriken, Streichholzfabrikanten, Wachszünderfabrikanten, Zündhölzche

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fabriken, Zündholztunker, Zündhütchenfabriken, Zündspiegelfabriken, Zündwaarenfabriken, Zunderfabriken.)

Die Erwerbsthätigen in diesem Beruf beziffern sich auf 9 067 Personen, wovon 5 614 = 61·9 Proc. männlichen und 3 453 = 38·1 Proc. weiblichen Geschlechts waren, die sich der Stellung im Beruf nac hfolgender Art verteilen:

	männlich	weiblich	zusammen
a) Selbständige	550	52	602
b) Verwaltungs- und Aufsichtspersonal .	301	3	304
c) sonstige Gehilfen und Arbeiter . . .	4 763	3 398	8 161

d. i. in Procenten der Erwerbsthätigen bei a = 6·6 Proc., bei b = 3·4 Proc., bei c = 90·0 Proc.

Mit den häuslichen Dienstboten und Angehörigen sind diese Erwerbsthätigen mit folgenden absoluten und Procentzahlen vertreten: bei a 2 345 = 10·9 Proc., bei b 853 = 4·0 Proc., bei c 18 198 = 85·1 Proc., in Summa 21 396 Erwerbsthätige, Dienende und Angehörige.

Nebensächlich bei der Anfertigung von Explosivstoffen und Zündwaaren waren 312 Personen — 227 Männer, 85 Frauen — anderer Berufe beschäftigt, so dass die Gesamtzahl der in diesem Berufe Thätigen 9 379 beträgt, und zwar 5 841 Männer und 3 538 Frauen.

5. Abfälle und künstliche Düngstoffe.

(Hierzu zählen: Abfuhranstalten, Abtrittsreiniger, Bedürfnissanstalten, Betriebsstätten für Cloakendesinfection und -Reinigung, Desinfectionsanstalten, Düngerfabriken, Grünfischer, Knochenmühlen, Knochenölfabrikanten, Knochensieder, Knochenstampfen, Kunstdüngerfabriken, Latrinenanstalten, Latrinenreiniger, Müllabfuhranstalten, Ochsenpfotenölfabrikanten, Poudrettefabriken, Strassenreinigungsanstalten, Superphosphatfabriken.)

Hier wurden 5 057 Personen, 4 621 = 91·4 Proc. männlichen und 436 = 8·6 Proc. weiblichen Geschlechts, als Erwerbsthätige ermittelt, die sich ihrer Stellung im Beruf nach folgender Art verteilen:

	männlich	weiblich	zusammen
a) Selbständige	449	23	472
b) Verwaltungs- und Aufsichtspersonal .	220	—	220
c) sonstige Gehilfen und Arbeiter . . .	3 952	413	4 365

d. i. in Procenten der Erwerbsthätigen bei a = 9·3 Proc., bei b = 4·4 Proc., bei c = 86·3 Proc.

Mit den häuslichen Dienstboten und Angehörigen sind diese Erwerbsthätigen mit folgenden absoluten und Procentzahlen vertreten: bei a 2 054 = 13·3 Proc., bei b 608 = 3·9 Proc., bei c 12 837 = 82·8 Proc., in Summa 15 499 Erwerbsthätige, Dienende und Angehörige.

724 Personen anderer Berufe, und zwar 673 männlichen und 51 weiblichen Geschlechts, waren nebensächlich in dieser Berufsart thätig, so dass hier 5 781 Personen, und zwar 5 294 männlichen und 487 weiblichen Geschlechts, den voraufbezeichneten Beruf als Haupt- oder Nebenberuf ausübten.

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II. Gesetzgebung, Verordnungen u. s. w.

Gesetz,

betreffend die Steuervergütung für Zucker. Vom 7. Juli 1883.

§ 1. An die Stelle der im § 3 des Gesetzes vom 26. Juni 1869, die Besteuerung des Zuckers betreffend (Bundes-Gesetzbl. S. 282), bestimmten Sätze der Steuervergütung treten für a. dieses Gesetzes vom 1. August 1883 für b. und c. vom 1. September 1883 ab die nachstehenden Sätze für je 50 kg: a) für Rohzucker von mindestens 88 Proc. Polarisation 9 M., b) für Kandis und für Zucker in weissen, vollen, harten Broden bis zu 12·5 kg Nettogewicht oder in Gegenwart der Zollbehörde zerkleinert 11,10 M., c) für allen übrigen harten Zucker, sowie für alle weisse trockene (nicht über 1 Proc. Wasser enthaltene) Zucker, in Krystall-, Krümel- und Mehlform von mindesten 98 Proc. Polarisation 10,40 M.

§ 2. Die Bestimmungen dieses Gesetzes treten mit dem 1. August 1885 ausser Kraft. Wird bis zu diesem Zeitpunkte ein anderweites Gesetz nicht erlassen, so treten mit diesem Zeitpunkte die Bestimmungen des Gesetzes von 1869 wieder in Kraft.

Transport flüssiger Kohlensäure.

Durch Beschluss des Bundesrates vom 10. März 1883 hat die Anlage D. No. XXXVIII zum § 48 des Eisenbahn-Betriebsreglements*) folgende veränderte Fassung erhalten: „Flüssige Kohlensäure und flüssiges Stickoxydul dürfen nur in Behältern aus Schweisseisen, Flusseisen oder Gussstahl, welche bei amtlicher Prüfung einen Druck von 250 Atmosphären ohne bleibende Veränderung der Form ausgehalten haben, zur Beförderung geliefert werden, Ein amtlicher Vermerk auf den Behältern muss deutlich erkennen lassen. dass die Prüfung hierauf und zwar innerhalb Jahresfrist vor der Aufgabe stattgefunden hat. Die Behälter sind fest in Kisten derart zu verpacken, dass der vorgedachte Vermerk bei der bahnseitigen Annahme ohne Schwierigkeit sichtbar gemacht werden kann."

*) Vgl. Techn. Chem. Jahrb. III. S. 42; auch IV. S. 9.

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B. Chemische Technologie.

I. Eisen.

A. Analytisches.

Eine Zusammenstellung der gebräuchlichsten Eisenanalysen giebt A. Tamm (aus Jern-Kont. Ann. 1882 S. 123 Bg. u. H. Ztg. 1882 S. 448); über die in Amerika üblichen analytischen Methoden berichtet M. Troilus (aus Jern-Kont. Ann. 1882 Hft. 8 Bg. u. H. Ztg. 1883 S. 254).

Zur Kohlenstoff-Bestimmung empfiehlt F. Watts in Chem. News die Wöhler'sche Methode: Verflüchtigung des Eisens im Chlorstrome und nachheriges Verbrennen des Kohlenstoffs im Sauerstoffstrome. — Bei Verbrennung des Kohlenstoffs mit Chromsäure empfiehlt A. Ledebur eine Kochflasche mit seitlichem Kugelrohr (St. u. E. 1882 Hft. 5). — Zur Absorption der Kohlensäure wird häufig Natron-Kalk angewandt, den auch H. F. Starr (Bg. u. H. Ztg. 1882 S. 532) besonders empfiehlt. — Einen neuen Apparat zur Filtration der mit Kupferchlorid-Chlorammon zersetzten Eisenlösung beschreibt M. Troilus (a. a. O.): In einem rechteckigen Platintrichter mit senkrechten Wänden sitzt ein eben solches Platinschiffchen, dessen Boden mit feinen Löchern versehen ist, die mit einer Asbestschicht bedeckt sind. Nach Filtration und Auswaschen wird das bei 100° C. getrocknete Schiffchen samt Inhalt direct in das Verbrennungsrohr gebracht.

Bei Bestimmung des Schwefelgehaltes leitet G. Craig (Chem. Ztg. 1882 No. 70) den Schwefelwasserstoff, gebildet durch Zersetzung des Eisens mit Salzsäure, in eine ammoniakalische Wasserstoffsuperoxydlösung. Ein Kupfergehalt des Eisens soll dabei keinen Einfluss üben. Jedoch ist die Wasserstoffsuperoxydlösung stets auf Schwefelsäure-Gehalt zu prüfen.

v. Jüptner empfiehlt bei der Siliciumbestimmung Lösen des Eisens in einem Gemisch von 3 Vol. Schwefelsäure (1·13) und 1 Vol. Salpetersäure (1·4 spec. Gew.), Kochen, Verdünnen und directes heisses Filtriren oder aber die salzsaure Lösung zur Trockne zu dampfen und mit Schwefelsäure wieder aufzunehmen. Stets muss aber die Salpetersäure vollständig ausgetrieben sein (Oestr. Ztschr. 1882 No. 44). — F. Watts verbrennt zur Bestimmung des Siliciums und der Schlacke das Metall im Chlorstrome. Si verflüchtigt sich als Tetrachlorid und wird durch Wasser zersetzt; die Schlacke bleibt zurück und wird auf einem gewogenen Filter zur Entfernung des Manganchlorür ausgewaschen. Man erhält so den Schlackengehalt plus Gesamtkohlenstoff. Das Chlorgas muss frei sein von Sauerstoff und Wasser.

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In Bg. u. H.-Ztg. 1882 S. 417 beschreibt A. Ledebur eine neue colorimetrische Manganbestimmung, geeignet für Eisen mit unter 20 Proc. Mn. Zur Ausführung der Methode bedarf man:

1. einige Standbüretten von ca. 12 mm Durchmesser und 30 cbcm Inhalt;

2. eine Normal-Manganlösung, dargestellt durch Auflösen von 0.0718 g krystallisirtem Kaliumpermanganat in 500 cbcm Wasser. 1 cbcm dieser Lösung enthält 0·00005 g Mn.

Man löst 0·2 g Eisen (bei geringhaltigem mehr) in 10—15 cbcm gewöhnlicher Salpetersäure und verdünnt auf 100 cbcm. Von diesen nimmt man 10 cbcm und fügt zu diesen ca. 2 cbcm Salpetersäure, erhitzt zum Sieden und setzt Bleisuperoxyd im Ueberschuss zu. Nach kurzem Erwärmen und Umschütteln filirirt man die erkaltete Lösung in eine der oben erwähnten Büretten durch ein Asbestfilter, das, bis es nicht mehr rot ist, mit kaltem Wasser ausgewaschen wird. Das Mangan ist nun als Uebermangansäure in der Lösung. In eine zweite Bürette bringt man je nach der Farben-Intensität der zu untersuchenden Probe 1—4 cbcm Normallösung und verdünnt diese so weit, bis beide Lösungen, gegen weisses Papier gehalten, gleiche Farbentöne zeigen.

Den Gehalt ergiebt die Formel $\frac{a}{b} \cdot c \cdot 0{\cdot}25$ Proc. Mn, wobei a die Anzahl der von der Normallösung entnommenen Cubikcentimeter; b die Anzahl der Cubikcentimeter, auf welche jene a cbcm verdünnt werden mussten zur Erreichung gleichen Farbentons mit der Eisenlösung und c die Anzahl Cubikcentimeter der Eisenlösung.

Vergleichende Versuche ergaben bei

	gewichtanalyt.	nach der neuen Probe
Stahl	0·48	0·48 Proc. Mn
Roheisen	0·77	0·79 „ „
Tiegelgussstahl	0·14	0·12 „ „
Roheisen	2·36	2·29 „ „
„	5·68	5·11 „ „

R. Schöffel und E. Donath schlagen eine andere volumetrische Mn-Bestimmung vor (St. u. E. 1883 S. 374). Fällung des Mangansalzes mittelst Permanganats als Mangansuperoxyd.*)

A. Ledebur bestimmte den Wasserstoffgehalt des Eisens und fand in Martinstahl 0·0017 Proc., in Ferromangan mit 70 Proc. Mn 0·0028 Proc. und in Ferrosilicium mit 11·3 Proc. Si ebenfalls 0·0028 Proc. H. Nachdem der Apparat mit Stickstoff gefüllt und das Verbrennungsrohr stark erhitzt war, wurde das zu untersuchende Eisen im trockenen Luftstrome verbrannt und der entstehende Wasserdampf in einem gewogenen, mit wasserfreier Phosphorsäure gefüllten Rohre aufgefangen. (St. u. E. 1882 S. 591.)

In einer Abhandlung über Analyse von Hüttengasen empfiehlt V. Eggertz die Bunte'sche Bürette. (Bg.- u. H. Ztg. 1883 No. 17 u. F. aus Jern.-Kont. Ann.)

*) Vgl. Chem. Kal. 1884 S. 187.

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B. Technisches.

I. Erze (vacat).

II. Roheisendarstellung.

von Tunner und von Kerpely berichten auf dem Herbst-Meeting des Iron and Steel Institute in Wien über die Lage der Eisenindustrie in Steiermark-Kärnthen und Ungarn. Obschon in den Ländern die Eisenerze an Güte und Menge unübertroffen sind (Ungarn führt jährlich $2^1/_2$ Mill. Zollcentner aus), so wirken doch viele ungünstige Momente einem Aufschwunge der Industrie hemmend entgegen, besonders der Mangel an gutem, mineralischem Brennstoff. Nur ein Hohofen von 68 in Ungarn (Reschitza) arbeitet ausschliesslich mit Coks. Die Holzkohlen-Roheisen-Erzeugung hat einen hohen Standpunkt erreicht. Brennstoffverbrauch auf einigen Werken: 83 Buchenkohle auf 100 Roheisen; Production pro Hohhofen und Monat 300—520 t. Die Jahresproduction in Ungarn beträgt 3 350 500 Zollcentner, davon $^1/_{10}$ Gusswaaren.

Die Flussstahlerzeugung hat in den Alpenländern eine grössere Ausdehnung und liefert ausgezeichnete Qualitäten, dagegen producirt Ungarn für die Erfordernisse der Landwirtschaft fast ausschliesslich Schmiedeeisen in Puddelöfen mit Siemens-Regenerativ-Gasfeuerung. Man hat dort bei den Oefen zwei Feuerbrücken angeordnet, wodurch aller Flugstaub niedergeschlagen und ein fast continuirlicher Puddelbetrieb ermöglicht wird.

Winderhitzung.

Mit der Frage der Winderhitzung, ob steinerne ob eiserne Apparate, hat man sich im verflossenen Jahre vielfach beschäftigt. Lürmann referirt ausführlich über Winderhitzungsapparate (St. u E. 1883 S. 23). Seine nachstehende Tabelle ergiebt Näheres über Heizfläche, Anlagekosten etc. der verschiedenen Apparate:

	Zahl der für einen Hohofen von 100 t Production zu erbauenden Winderhitzer.	Zahl der in Betrieb befindlichen Winderhitzer.	Heizfläche pro Apparat qm	Heizfläche pro cbm Wind erbaut	Heizfläche pro cbm Wind benutzt	Anlagekosten pro Apparat ℳ
1. Whitwell, ältere Constr.	4	3	900	8	6	50 006
2. „ neuere „	2·5	2	2400	13·3	10·66	32 000
3. Cowper	3	2	4800	32	21·33	40—48 000
4. Massiks & Crooke . .	3·5	3	1440	11·1	9·6	20 000
5. Harvey	2·5	2	4600	25·5	20·4	33 000
6. Gjers	6	—	163·7	2·18	2·18	16 660

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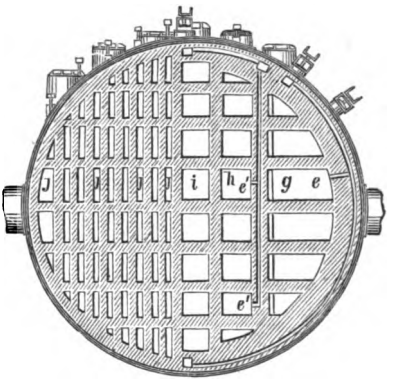
Th. Whitwell hat an seinem Winderhitzungsapparat Verbesserungen angebracht (D. P. 17851 vom 28. August 1881), die eine Temperatursteigerung bis auf 800° ermöglichen sollen (Fig. 1). Die Neuerungen bestehen in der Anordnung der Canäle *g h* und *i* von solchem Querschnitt, dass das Gas in diesen Canälen durch Zutritt atmosphärischer Luft mittelst Oeffnungen *ee'* in der ganzen Höhe des Canales *g* und am Fusse des Canales *h* vollständig verbrennen kann, wobei diese Canäle durch ihren Querschnitt die Möglichkeit vollständiger Reinigung der Canalwände von angesetztem Russ und anderen Verbrennungsproducten bieten. Eine fernere Neuerung liegt in der dargestellten Anordnung der Canäle *j j*, welche wie *g*, *h* und *i* zur Lufterhitzung dienen.

Fig. 1.



An den Cowper-Apparaten der Edgar-Thomson-Werke hat J. Kennedy Verbesserungen angebracht. (Eng. a. Min. Journ. v. 27. Jan. 1883.) Die Canäle des Regenerators sind nicht viereckig, sondern rund; Durchm. 152 mm; die Steine sechseckig; die Gase durchziehen nur einmal den Regenerator. Gusseisen, das sich leicht wirft oder reisst, ist zum Tragen der Schächte vermieden. Die Gase der Apparate und der Kessel werden durch dieselbe Esse abgeführt. Temperatur der Apparatsgase an der Esse 175° C. Innerer Durchmesser des Apparats 6·4 m; Höhe 22 m. — Der Winderhitzer von H. Massiks und W. Crooke besteht nach D. P. 17655 vom 26. Juni 1881 aus ringförmigen, durch radiale Wände geteilten Kammern. Die heissen Gase treten in die um die Achse des Apparats gelagerten Kammern ein und durchziehen dieselben in der Richtung nach dem Umfange hin, während die zu erhitzende Luft den entgegengesetzten Weg nimmt. Der Abzug der Gase zum Schornstein ist unter dem Boden des Apparats. In Askam 15 solcher Apparate für 4 Oefen. (Iron u. Steel I. 1882 S. 602.) — Th. F. Harvey hat Neuerungen an Winderhitzern vorgenommen (D. P. 21341 vom 21. Mai 1882 Fig. 2). Die Erhitzungsgase werden nur von unten nach oben, der Wind nur von oben nach unten geführt. Solche Winderhitzungsapparate werden mit einem Hochofen in einem den letzteren ringförmig umschliessenden Raum verbunden. *A* ist das Ventil, durch welches das aus dem Hochofen kommende Gas unten in eine der mit feuerfestem Material ausgekleideten Tragsäulen *B* einströmt. Das Gas vermischt sich mit der durch geeignete Ventile *C* in den Feuerraum *D* eintretenden Luft. Dieser Feuerraum ist horizontal am Boden der Gebläseöfen angeordnet. Die Verbrennungsproducte steigen durch die Regenerativöfen *E* empor und en-

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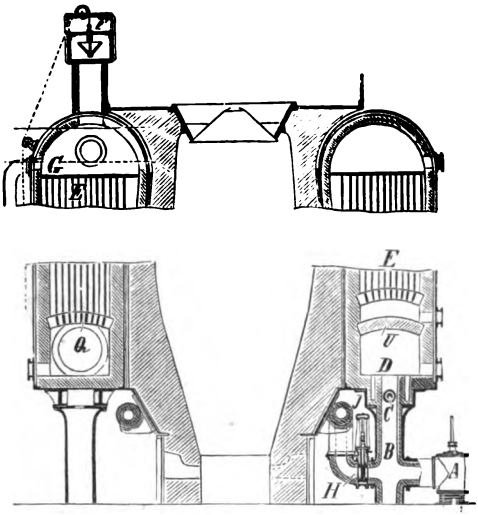
Fig. 2.



weichen durch den Schornstein *F*, welcher in Höhe des Gebläseofens mit einer Klappe versehen ist. Der kalte Gebläsewind, welcher erhitzt werden soll, tritt oben bei *G* ein, nimmt seinen Weg durch den Regenerator *E* in der umgekehrten Richtung zu dem vom Gase beschriebenen Weg herab und tritt durch das Heissluftventil *H* in das Windleitungsrohr *J* des Hochofens.

Eine Vorrichtung zum Reinigen der Canäle hat sich Cowper patentiren lassen (Engl. P. 2381). — In Oberschlesien, wo wegen des hoch zink- und bleihaltigen Flugstaubes ausschliesslich eiserne Apparate in Gebrauch sind, will man nunmehr steinerne Apparate versuchsweise anwenden (St. u. E. 1883 S. 23 u. Ztschr. d. oberschl. Bg.- u. H.-W., Februar 1883). Zunächst soll jedoch versucht werden, den Zinkstaub durch mechanische Vorrichtungen als Verringerung der Geschwindigkeit, Filtration durch Coks oder Schlacke möglichst zu entfernen.

Auf der Hütte zu St. Nazaire hat man zwei Arten Gasstaub-Reiniger erbaut (St. u. E. 1883 S. 69). Der erste beruht darauf, dass man die Gase durch einen horizontalen, durch Scheidewände getrennten Kasten strömen lässt; die Geschwindigkeit des Windes wird hier wie beim zweiten von 6·5 auf 1 m vermindert. Bei dem anderen Gasstaub-Reiniger lässt man die Gase von oben durch ein inneres Rohr bis in das untere Drittel eines weiten (5 m) Reinigers eintreten, der nach unten konisch zuläuft. Der Gasabzug des letzteren ist oben angeordnet, so dass die Richtung der Gase umgekehrt wird.

C. Steffen (St. u. E. 1883 No. 5 u. No. 6) und H. Fehland (St. u. E. 1883 S. 330) „über Winderhitzungsapparate".

Hochofenbetrieb.

Ueber die Reduction oxydirten Eisens durch Kohlenoxyd hat R. Akerman eine grosse Reihe von Versuchen anstellen lassen (Jern-Kont. An.; St. u. E. 1883 S. 149). Die Reduction von Eisenoxyd zu Oxyduloxyd erfolgt leicht; dagegen ist die Sauerstoffentziehung des letzteren nicht möglich bis zu einer Temp. von 900°, selbst wenn auf 3 Vol. Kohlensäure

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1 Vol. Kohlenoxyd kommen; sicher erfolgt sie erst, wenn bei genannter Temperatur das Verhältniss der Gase wie 0·6 zu 1 ist. Eisenoxydul wird bei derselben Temperatur und einem Verhältnis der Gase wie 0·4 zu 1 leicht reducirt. Akerman berechnet, dass, soll die Reduction des Erzes im Hochofen ausschliesslich durch Kohlenoxyd erfolgen, 64·3 Kohle auf 100 reducirtes Eisen kommen müssen. Da aber bei den schwedischen Holzkohlen-Hochöfen der Kohleverbrauch auf producirtes Roheisen oft geringer ist, so folgt, dass ein grösserer Teil des Erzes direct durch Kohle reducirt werden muss. Die hierdurch bedingte Wärmeverminderung erklärt die Thatsache, dass bei Hochöfen mit heissem Wind die Temperatur an den Formen höher, in den oberen Regionen kälter ist, als bei Hochöfen mit kaltem Winde. — C. Cochrane (Iron v. 2. Febr. 1883) sagt, dass der grösste Wärmeverlust im Hochofen herbeigeführt wird durch Rückbildung von Kohlensäure zu Kohlenoxyd; dem lässt sich entgegenwirken durch Calciniren des Kalksteins und möglichstes Zerkleinern des Erzes. Je heisser der Wind, je kälter die abziehenden Gase, desto geringerer Verbrauch an Brennmaterial; je höher das Verhältnis der Kohlensäure zu Kohlenoxyd in den Gichtgasen, desto grössere Ersparnis an Brennstoff. — In einem anderen Aufsatze spricht derselbe Verf. (Iron 30 No. 14) über den Einfluss der Stellung der Formen auf die Production des Hochofens. — L. Bell vergleicht die Betriebsresultate bei Holzkohlen- und Coks-Hochöfen (Iron & Steel 1882 S. 534). Während der Coksverbrauch in England pro Tonne Roheisen mindestens 1 t Coks ist, kommen auf 20 Ctr. steyersches Roheisen 12—15 Ctr. Holzkohle. Bei den Cleveländer Oefen ist der Wärmeverlust durch höhere Temperatur und Menge der Gichtgase grösser, ferner durch Vergasung von Kohlenstoff zu Kohlensäure in der Beschickung. Auch glaubt Verf., dass die Holzkohlen, reicher an Alkalien, mehr Cyanverbindungen mit ihrer hohen reducirenden Wirkung entwickeln. Auch das Verhältnis zwischen Kohlensäure und Kohlenoxyd in den Gichtgasen ist ein anderes. — C. Stöckmann (Ersetzung des Kohlenstoffs durch Silicium im Ferromangan, St. & E. 1883 S. 197) kommt zu dem Gesetz, dass im Ferromangan Silicium den Kohlenstoff theilweise oder ganz nach dem Verhältnis der Atomgewichte vertreten kann.

In Schottland hat man angefangen Ammoniak als schwefelsauren Ammoniak aus den Hochofengasen zu gewinnen; hierauf zielt ein engl. Patent von J. Addie.

Verwendung der Hochofenschlacke. L. Roth hat ein Patent genommen über die Herstellung von Cement aus Hochofenschlacke, Kalkstein und Bauxit. Das Gemenge wird zuerst schwach erhitzt und schliesslich scharfer Weissglut ausgesetzt; es soll hierdurch das schädliche Schwefelcalcium zersetzt werden. Auf der Sophienhütte bei Wetzlar soll das Verfahren jetzt eingeführt werden. (Wochenschr. d. V. d. Ing. 1882 No. 49.)

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III. Darstellung des schmiedbaren Eisens.

1. Raffination des Roheisens.

M. Tidier (Paris) prüfte das Patent von L. Cely, das bezweckt die Metalloide, wie S, P, Si, C, aus Roheisen, Stahl oder Schmiedeeisen geringerer Qualität durch Glühen in feuchtem Wasserstoffgase zu entfernen. Zu seinen Versuchen verwandte Tidier Gusseisenretorten, die ca. 1 t Metall fassen und die innen und aussen mit alkalischer Silicatbase verglast sind. Nach der Chargirung und Erhitzung auf Dunkelrotglut füllte er die Retorte zuerst mit Kohlensäure zur Beseitigung von Explosionsgefahr, alsdann mit wasserdampfhaltigem Wasserstoff; dies Gas wird bei Schluss der Operation durch Kohlensäure wieder ausgetrieben. Die Versuche erstreckten sich bislang auf hämmerbaren Guss, der schmied-, schweiss- und härtbar wurde und ein feines Korn zeigte und auf Stahl, der in Werkzeugstahl 1. Qualität umgewandelt wurde. Die Kosten sollen sich auf 2 Francs pro 100 kg belaufen. (Bg.- u. H. Ztg. 1883 S. 47.)

In St. u. E. 1883 S. 305 (aus Bull. d. l. Soc. de l'Ind. min.) wird berichtet über die praktischen Erfolge des Verfahrens von A. Rollet, die Entschwefelung und Entphosphorung des Roheisen im Basischen Cupolofen betr.*) Der Wind wird durch Düsen in verschiedener Höhe zugeleitet; Windtemperatur ca. 375° C., Pressung möglichst hoch. Der Ofen muss gekühlt werden. Der Kalkzuschlag beträgt bis zu 10 Proc., der von Flussspat bis zu 5 Proc. Schwefel soll bis zu 90 Proc., der Phosphor bis zu 80 Proc. entfernt werden.

2. Schweisseisen-Darstellung.

a) Puddelprocess.

In der Eisenhütte zu Ougrée haben sich bei Einrichtung der Puddelöfen nach dem Bicheroux-System folgende Vorteile bemerkbar gemacht: Ersparnis an Brennstoff (ca. 1/3), Verminderung des Abbrandes um ca. 3 Proc. bei Verbesserung des Productes und Vergrösserung der Charge. Die abziehenden Gase können ebenso gut zur Kesselfeuerung benutzt werden. Erbauungskosten eines Ofens ca. 2 000 Francs. (Ann. indstr. 14, I, S. 590.) — Es wird empfohlen bei dem Puddelprocess ein hochsiliciumhaltiges Roheisen zu verwenden und auf eine Charge von 220 kg ausser vorherigem Kalkzuschlag bei Anfang des Schmelzens 1·2 kg doppelkohlensaures Natrium und 0·8 Kalk zuzusetzen zur Elimination von Schwefel und Phosphor und zur Bildung eines leicht flüssigen Silicats (St. u. E. 1882 S. 386). — Ueber Betriebsresultate der Pernot-Oefen der Cambria-Stahlwerke in Nordamerika berichtet Troilus. (Aus Jern.-Kont. Ann.: Bg.- u. H. Ztg. 1883 S. 209.)

b) Directer Process.

Der directe Process von C. W. Siemens (vergl. Jahrg. 1882 S. 57) ist nun nach den Erfolgen in Tyrone und der Siemens Anderson Steel Comp.

*) Techn.-chem. Jahrb. 1883, S. 23.

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bei Pittsburgh über das Versuchsstadium hinaus. — J. Davis (Iron 20 S. 482) und G. W. Maynard (Iron 20 S. 378; St. u. E. 1883 S. 253) berichten über Betrieb und Betriebsresultate: Die Reduction des Eisenoxyduloxyd zu Oxyd erfolgt schnell; letzteres beginnt zu schmelzen und wird dabei durch die Kohle zu Eisen reducirt. Hat sich das Eisen zusammengeklumpt, so wird die Schlacke abgelassen, die den Schwefel- und Phosphorgehalt mitnimmt. Die stark schlackenhaltigen Ballen werden herausgenommen und unter dem Dampfhammer oder in einer Quetsche zu einer Luppe gezwängt. Die Luppen kommen zur Weiterverarbeitung in den Siemens-Martinofen, wo sie bis $^1/_3$ der Charge ausmachen können; jedoch sagt J. Davis, dass sich aus den Luppen direct gutes Rohstabeisen walzen liesse. Analyse: Si = 0·4, C = 0·15, P = 0·05, S = Spur u. Mn = 0·2 Proc. Die Rotatortrommel zu Landore hat einen inneren Durchmesser von 3·15 m und dieselbe Länge; zu jeder Trommel gehören 2 Gaserzeuger und 2 Regeneratoren. Die Trommel ist rund mit $3^1/_2$zölligen feuerfesten Steinen ausgefüttert, am Hals mit Magnesiasteinen; darüber eine 2 Zoll starke Schicht von Hammerschlag und Erz. — Eine Charge beträgt 1 t Erz, 0·6 t Hammerschlag und 0·3 t Reducirkohle. Vom 22. Mai bis 8. Juli 1882 wurden zu Landore in 7 Compagnien und in 200 Chargen 200 t Erz mit 60 t Kohle und 120 t Hammerschlag bei Aufwand von 227 t Generatorkohle zu 217 t Blooms verarbeitet. Eine wesentliche Verbesserung des Processes wurde herbeigeführt durch das Anbringen von Kühlröhren im Rotatormantel;*) hierauf bezieht sich das Zusatz-Patent 21220 vom 28. März 1882 von C. W. Siemens: An den im Patent 2495 beschriebenen Schmelzöfen sind durch Wasser gekühlte Ausbauchungen *H'* (Fig. 4) und *M* (Fig. 3) in der inneren Ofenwand angebracht, damit sich dort Kegel von erstarrtem Metall oder erstarrter Schlacke bilden. Diese Einrichtungen stehen mit einem den Ofen umgebenden Wassermantel *H* (Fig. 4) oder mit Kühlröhren *L*, welche am Füllende des Ofens angebracht sind, (Fig. 4) in Verbindung.

Fig. 3.

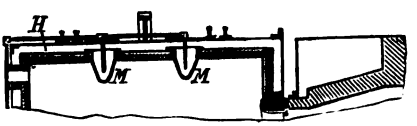
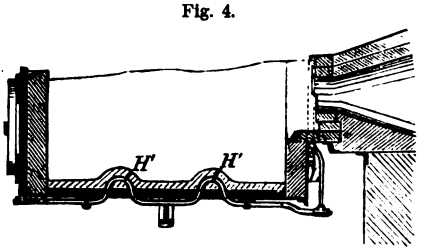


Fig. 4.



3. Darstellung des Flusseisens.

a) Im Convertor.

Ueber den **Bessemer-Process** veröffentlicht C. A. Casperson (Westanfors) Studien (St. u. E. 1883 S. 71), die zusammengefasst sind in einem

*) Vgl. Techn.-chem. Jahrb. 1882, S. 57.

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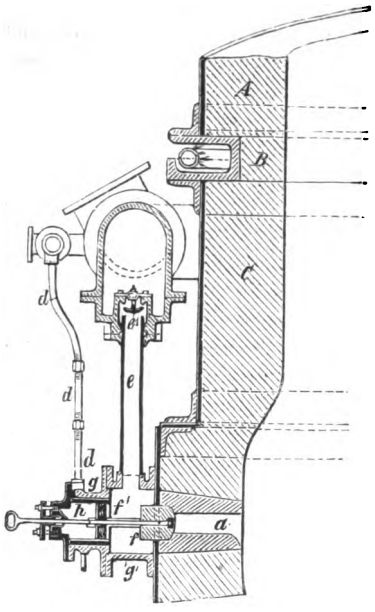
Schema, welches den Zusammenhang nachweist zwischen dem Wärmegrad der Bessemer-Charge und der Dichtheit und dem Härtegrad des Ingots. — Neuerungen an stehenden Bessemeröfen haben sich W. J. Clapp und Th. Griffith patentiren lassen (D. P. 18250 v. 28. September 1881), Fig. 5.

Fig. 5.



Jede Form ist an ihrem unteren Ende mit einem Stöpsel *f* versehen, um den Wind, wenn nötig, abzusperren. Die Stange am Stöpsel *f* trägt einen Kolben *f'*, der in einem Cylinder *h* arbeitet, so dass, wenn Dampf hinter den Kolben *f'* gegeben wird, der Stöpsel *f* fest auf seinen Sitz gepresst wird. Zum Zurückziehen des Stöpsels, wenn die Windpressung allein hierzu nicht genügen sollte, ist die Stange durch eine Stopfbüchse nach aussen geführt und mit einem Handgriff versehen. Der Cylinder *h* steckt in einem Mantel *g*, der den Deckel mit der Stopfbüchse und das Dampfrohr *d* trägt. Derselbe ist an den am Converter befestigten Kasten *g'* geschraubt. An diesen Kasten geht das Windrohr *e*, dessen obere Oeffnung durch das Ventil *e'* geschlossen werden kann, wenn die betreffende Form nicht gebraucht wird, indem das Rohr *e* bis an das Ventil *e'* gehoben wird. Zu diesem Zwecke ist das Ventilgehäuse mit Stopfbüchse versehen und wird in dieser Lage durch einen untergeschobenen Keil gehalten. Das Zurücktreten des flüssigen Metalls in die Form wird also dadurch verhindert, dass der Stöpsel *f* mittelst Dampfdruckes auf den Kolben *f'* auf seinen Sitz gepresst wird, während wenn der Dampf abgesperrt und der Wind angelassen wird, der Druck des letzteren auf den Kolben *f'* den Stöpsel *f* von seinem Sitz abhebt, wodurch der Wind durch die Form *a* in den Converter *C* einströmt. — Die zweite Neuerung besteht in der Anordnung eines trogförmigen Zwischenstückes *B* mit Wasserkühlung zwischen Unter- und Oberteil des Ofens.

J. Reese macht den Convertor fahrbar, so dass auf demselben Untergestell zwei Convertoren in Betrieb sein können; die Windzuleitung erfolgt durch bewegliche Gelenke. — Dango & Dienenthal (Siegen) haben für die Windleitungen der Bessemer-Birnen Explosionsschutzklappen construirt. Durch den Winddruck schliesst die Klappe das Windrohr nach aussen ab, während sie beim Abstellen des Windes zurückfällt, das Windrohr schliesst und gegen den Zutritt von Gasen absperrt.

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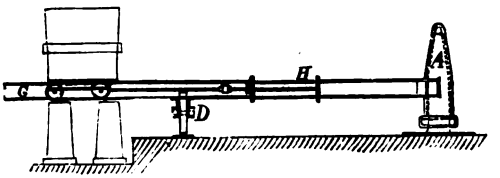
Eine Giessvorrichtung für zwei Coquillen-Reihen construirte R. M. Daelen (D. P. 19076 vom 7. Februar 1882, Fig. 6). Der Laufkran besteht aus dem um die Achse *A* drehbaren Gestell *G*, welches durch zwei Rollen *D* unterstützt wird. *H* ist eine hydraulische Vorrichtung, welche zum Verschieben des Pfannenwagens dient. Letzterer ist mit Rädern, welche zwei Spurweiten bilden, und mit einer Einrichtung zum Absetzen desselben von einer Spurweite auf die andere versehen.

Fig. 6.



Auf die Erzeugung dichter Stahlblöcke zielen wiederum einige Patente hin; so das von F. A. Krupp (D. P. 21324 vom 25. Juni 1882): Zum besseren Warmhalten der Köpfe von Güssen aus Metallen aller Art, vorzugsweise Stahlgüssen, werden dieselben mit einem Mantel umgeben, der mit heissen flüssigen oder feinkörnigen Körpern, besonders flüssigen Schlacken oder heissem Sande, gefüllt ist. J. D. Ellis bringt nach einem englischen Patent auf dem oberen Teil der Coquille ein aus schlecht leitendem Material bestehendes Aufsatzstück an, in welchem zur Ausfüllung der Blasenräume eine Quantität flüssigen Metalls zurückgehalten wird. Der Stahl tritt von unten in die Coquille.

Der **Thomas-Process** dehnt sich immer weiter aus, besonders auch in Deutschland; so haben die oberschlesischen Werke im Juni d. J. das Patent erworben. Ende 1882 waren überhaupt im Betrieb 39 Convertoren, davon 22 in Deutschland, im Bau begriffen waren 34; die monatliche Production belief sich zu jener Zeit überhaupt auf 47 000 t, davon beträgt die deutsche 26 000 t.*) Gilchrist schätzt die Production im laufenden Jahre auf das doppelte. — In der Monatsschr. d. V. dtsch. Ing. 1882 S. 532 findet sich eine detaillirte Angabe sämtlicher Patente, die bisher auf den basischen Process genommen worden sind. Thomas & Gilchrist, Ueber den basischen Process (St. u. E. 1882 S. 294).

Die Herstellung des basischen Ofenfutters aus rohem Dolomit nach dem Thomas-Patent 5869 erfolgt fast durchgängig nicht mehr. Die nunmehrige Herstellung ist kurz folgende: Der zerkleinerte Dolomit wird durch Coks in besonders eingerichteten, basisch ausgemauerten Cupolöfen mit Ventilatorgebläse calcinirt (auf 100 kg Dolomit ca. 60 kg Coks). Die gebrannte, theilweise gefrittete Masse wird von Coks und Schlacke befreit, gemahlen und hierauf mit 7 Proc. wasserfreiem Teer und etwas Thon vermischt. Mit dieser Masse wird der Convertor entweder direct ausgestampft (z. B. Le Creusot, North Eastern Steel Co., Middlesborough), oder sie wird in Formen zu Façonsteinen gestampft, die hierauf einem nochmaligen Erhitzen

*) Vergl. Techn.-chem. Jahrb. 1883 S. 25.

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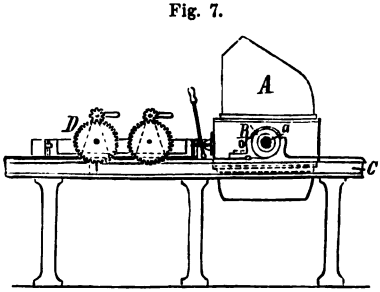
in offenen Oefen ausgesetzt werden (z. B. Rh. Stahlwerke). In Le Creusot beträgt die Dicke der basischen Masse am Boden 650 mm, an den Wänden 450 mm und soll der Boden 15—20, das Seitenfutter 80—100 Chargen aushalten (ebensolche Haltbarkeit in Peine). Zusammensetzung der Masse: $CaO = 53$, $MgO = 35{\cdot}8$, $SiO_2 + Al_2O_3 = 7{\cdot}7$ Proc. — Von den zahlreichen Patenten*), die eine geänderte Herstellung des basischen Futters zu erreichen suchen, scheinen nur diejenigen in der Praxis sich einzuführen, die aus magnesiahaltigen Rohproducten und Rückständen Magnesia auf eine billige und praktische Art abscheiden. Die Magnesiaziegel haben gegen das Kalk-Magnesia-Futter den Vortheil grösserer Feuerbeständigkeit, sie zerfallen nicht durch Feuchtigkeit und schwinden nicht so stark; gegen ihre Anwendung ist nur der bisherige theure Preis. In Hörde werden gegenwärtig mit dem Scheibler'schen (D. P. 14936) und dem Closson'schen Magnesia-Herstellungs-Verfahren Versuche gemacht. S. G. Thomas stellt Magnesiaziegel nach dem englischen Patent 4384 vom 8. October 1881 wie folgt her: Magnesia, deren Hydrat oder Carbonat, deren Gehalt an Kieselsäure 5 Proc. nicht übersteigt, wird in Blöcke geformt, die bei intensiver Weissglut gebrannt werden. Das Material, dessen Volumen stark abgenommen hat, wird zermahlen und mit Oel oder Wasser, Teer und dergleichen zu einer plastischen Masse gemischt, aus welcher unter Zusatz von Coksstaub oder Graphit Ziegel geformt werden. Diese Ziegel werden wiederum starker Weissglut ausgesetzt. Sie erleiden dann keine Schwindung mehr. — Der Totalverbrauch an feuerfestem Material soll sich pro Tonne Thomasstahl auf 45 kg belaufen.

Ueber die chemischen Vorgänge während des basischen Processes hat Finkener (Mitteilungen aus den kgl. techn. Versuchsanstalten Berlin; 1883 Heft 1) umfassende Versuche angestellt. (Es ist hierbei jedoch die Behauptung nicht richtig, dass „der Schwefelgehalt im wesentlichen nicht vermindert werde"; der Schwefelabbrand beim Thomas-Process beträgt thatsächlich 60—70 Proc.)

Behufs leichterer Auswechselung der Bessemer-Birne besonders bei Einrichtung älterer Anlagen für den basischen Process hat sich W. M. Henderson Neuerungen patentiren lassen (D. P. 19635 vom 17. Januar 1882). Diese Convertoren, Fig. 7, weichen von den bekannten dadurch ab, dass ihre Drehzapfen *a* sich nicht in festen Lagern drehen, sondern mit Spurrädern *B* versehen sind, welche auf einem durch Träger *CC* gebildeten Geleise laufen. Die Birne wird in ihrer Arbeitsstellung durch Widerlager, zwischen welchen die Spurräder *B* ruhen, festgehalten. Die Widerlager rechts sind fest, die auf

Fig. 7.



*) Vergl. Techn.-chem. Jahrb. 1882 S. 63.

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der andern Seite sind mittelst Keile etc. mit den Trägern so verbunden, dass sie leicht entfernt werden können. Die Birne wird mittelst eines vierrädrigen, mit Handkurbeln und Vorgelege versehenen Wagens *D*, mit dem sie gekuppelt ist, fortbewegt. Der mittlere Teil des Birnenmantels, an dem sich die Drehzapfen befinden, besteht aus zwei concentrischen Ringen aus Walzeisen. Den hierdurch geschaffenen Raum durchströmt die Gebläseluft, bevor sie in die Birne eintritt, und kühlt dabei den mittleren Teil des Birnenkörpers. — A. Trappen (Mtschr. d. V. dtsch. Ing. 1883 S. 73) construirte einen fahrbaren Giesskran für Bessemer- und Thomas-Hütten; derselbe bedingt parallele Lage der Convertoren. Vor diesen das Geleise für den Kranen; die langgestreckte Giessgrube liegt entweder auf der andern Seite den Birnen gegenüber (Hörde) oder aber auf derselben Seite seitwärts der Convertoren und ausserhalb des Schmelzhauses, wodurch das Drehen des Kranen um 180° gespart wird (Peine). Die Leistung desselben wird auf 40—45 Chargen à 10 t pro Doppelschicht geschätzt. — Holley empfiehlt Abschaffung der tiefen Giessgruben, da sie unpraktisch sind für die Fortschaffung der grossen Schlackenmenge.

Ueber den Betrieb des Thomas-Processes zu Le Creusot berichtet ausführlich Delafond (Ann. d. mines liv. 2 1882): Das Thomas-Roheisen dort enthält C = 3, Mn = 2, Si = 1·3, P = 2·5 und S = 0·2 Proc.; zur Herstellung desselben bedarf es grosser Hitze im Hohofen und viel Zuschlag von Kalk und Mangan. Vor Spiegelzusatz giesst man (ebenso wie in Peine) die Schlacke ab und erhält so ein vorzügliches Material. Kalkzuschlag 18 Proc. und $1^1/_2$ Proc. Flussspat, Abbrand 18 Proc. Die durchschnittliche Zusammensetzung der Chargen von 2 Monaten ist in Le Creuzot

bei Bessemer-		bei Thomas-Stahl
0·4 Proc.	= C	= 0·43 Proc.
0·3 „	= Si	= Spur
0·04 „	= S	= 0·029 „
0·075 „	= P	= 0·06 „
0·66 „	= Mn	= 0·76 „

73·2 durchschn. Bruchfestigkeit pro qmm 72·0

17·2 Proc. Dehnung 16·1 Proc.,

jedoch zeigte der basische Stahl grössere Gleichförmigkeit; bei Belastungs- und Fallproben war durchschnittlich die Durchbiegung bei saurem Stahl grösser. — An einzelnen Orten in England giebt man den Spiegelzusatz in die Giesspfanne, nachdem die Hälfte des Stahls ausgegossen ist. — K. Wittgenstein und A. Kurzwernhart berichteten auf dem Herbstmeeting des Iron- & Steel-Institute über den Thomas-Process in Teplitz. Der gesamte Brennstoff ist Braunkohle ausser 0·1 Proc. Coks zum Anwärmen des Convertors und der Pfanne. Das Roheisenschmelzen geschieht in Siemens-Regenerativ-Oefen (Herdlänge 3·8 m, Breite 2 m) mit Treppenrosten; in 24 Stdn. 8 Chargen; Braunkohlenverbrauch 45 kg pro 100 kg Eisen; aller-

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dings reducirt sich der Mangangehalt von 2 auf 0·6 Proc. Spiegeleisen wird vorgewärmt zugesetzt.

Märcker (Frühling's landw. Ztg. 1882 S. 334) empfiehlt die Thomasschlacke zur directen Verwendung als Düngemittel. — G. Witz und F. Osmond haben aus der Schlacke Vanadiumverbindungen hergestellt. Vanadium folgt in allen Stadien dem Phosphor (Chem. Ztg. 1882 S. 1065). — G. Rocour (D. P. 21240 vom 28. Januar 1882) gewinnt durch reducirendes Schmelzen der phosphorhaltigen Schlacke in einem Schachtofen einen Lech, der fast die gesammte Eisen-, Mangan- und Phosphormenge enthält. Zersetzen des granulirten Lechs mit heisser Salz- oder Schwefelsäure, Verbrennen des entwickelten Schwefel- und Phosphorwasserstoffs und Auffangen der gebildeten wässerigen Phosphorsäure in einer besonderen Condensationscolonne. Aus dem Rückstande wird der restirende Phosphor als phosphorsaures Kalium gewonnen.

b) Im Siemens-Martin-Ofen.

Die Production an saurem Siemensstahl ist in stetiger Zunahme begriffen; dieselbe betrug nach Berggeist 1882 No. 42 im Jahre 1882: 338000 t. In dem Siemens'schen Stahlschmelzofen (D. P. 19289 vom 25. Aug. 1881) sind in dem Herdfutter in der Höhe der Schlackenlinie Kühlröhren angebracht. Hierdurch soll der Sandboden des Schmelzofens an den Punkten geschützt werden, wo er am leichtesten durch Eisenoxyd angegriffen wird. Ferner sind Luftzuführungscanäle im Fuchse angeordnet; sowie durchgehende Steine in dem doppelten Gewölbe des Ofens, an denen sich die durchströmende Luft erhitzen soll. — Nach H. Angerstein (D. P. 18033 v. 5. Juli 1881) wird Wasserdampf von mindestens 600—700° C. bei Benutzung eines Ofens von vier bis fünf Tonnen Fassung durch eine Düse von 10 mm Durchmesser, welche ein halbes Meter vom Metallbade entfernt bleibt, eingeführt. Gleichzeitig mit dem erhitzten Wasserdampf kann Wind auf oder in die Schmelzmassen geblasen werden. — v. Ehrenwerth (Oestr. Ztschr. V. M. 1882 No. 5) hat Versuche gemacht, Eisenerz statt Abfälle zu verwenden. Er bezeichnet die Versuche als gelungen, obschon die Ofenzustellung mehr leidet, die Temperatur heisser und die Schlackenmenge grösser ist. — Ueber die Fortschritte zu Terre-noire in der Fabrikation dichter Stahlgüsse berichtet A. Pourcel (Iron & Steel 1882 S. 609 und St. u. E. 1882 S. 492). Diese Mitteilungen stellen es fest, dass es möglich ist, mit Hilfe vom Ferromangansilicium dichte und weiche Stahlgüsse zu erzeugen. Das Ferrosilicium wird rotglühend direct vor dem Gusse zugesetzt; es soll ein Minimum von Kohlenstoff enthalten (Si = 13·5, Mn = 17 u. C = 2 Proc.) (vergl. S. 5.) Die Fabrikation ist gerichtet auf Herstellung grosser Gussstücke und auf die Methoden des Temperns und Anlassens.

Wie sich gezeigt hat, bietet die Entphosphorung im Siemens-Martin-Ofen*) mancherlei Vorteile gegen die im Convertor. Herstellung

*) Vergl. Techn.-chem. Jahrb. 1882 S. 64.

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und Unterhaltung des basischen Futters, Zusetzen des Kalks, Abziehen der Schlacke bieten weniger Schwierigkeiten und die Leitung der Charge ist bedeutend erleichtert. Das Gewölbe des Ofens besteht stets aus kieselhaltigen Steinen, Wände und Boden aus basischer Masse; Schwierigkeiten bietet die Auffindung und Herstellung einer passenden neutralen Schicht, die sich zwischen Beiden befinden muss. In Le Creusot (Ann. des mines VIII S. 366) schaltet man eine Bauxit-Schicht ein, in Alexandrowski bei Petersburg (St. u. E. 1882 S. 599) eine Masse, bestehend aus Chromerz und Steinkohlenteer. Beim Anheizen des Ofens belegt man zur Verhütung einer Anschwellung der Masse, Boden und Wände dicht mit Schienenenden und Eisenplatten. Die Charge besteht zu $^1/_3$ aus Phosphor-Roheisen, dem gefrischtes Eisen zugesetzt wird; während der Frischperioden drei- oder viermaliger Kalkzuschlag und Abziehen der Schlacke. Grösse der Charge in Le Creusot 15 t, Dauer 12 Stdn.; in Alexandrowski 7 t, Dauer $9^1/_2$ Stdn.; Abbrand 11 Proc.

III. Weitere Verarbeitung des Eisens.

a. Gusseisen.

O. Gmelin (Pest) hat einen neuen Cupolofen construirt, der sich in der Waggonfabrik Ganz & Co. dort sehr bewährt haben soll. Auf einem 300—350 mm hohen Ring von Mauerwerk, durch welchen das Roheisen-Abstichloch geht, steht ein Doppelcylinder aus Kesselblech, der mit einem 30—50 mm starken, feuerfesten Futter überzogen ist. In dem 100—120 mm weitem Raume dieses Doppelcylinders circulirt Kühlwasser, das unten zu- und oben abgeleitet wird. Vorteile: Längere Haltbarkeit des Blechmantels und des Mauerwerks, Möglichkeit der Anwendung höherer Windpressung, dadurch Brennstofferparnis. Der Ofen in Pest hat eine Höhe von 4 m bei 850 mm lichtem Durchmesser; Winddruck 400—450 mm Wassersäule; Coksverbrauch 8 Proc.; stündliche Schmelzung von 4500—5000 kg. Die durch die Ofenwand transmittirende Wärme beträgt 15 Proc. der überhaupt entwickelten (Oestr. Zeitschr., 2, St. u. E. 1882 S. 627). — Fl. Besson (D. P. 19051 vom 13. Dec. 1881, Fig. 8.) hat an dem Cupolofen mit getrenntem Eisenherde einen besonderen Verbrennungsraum *B* angebracht, in welchen die als Brennmaterial dienenden Gase eingeführt werden, ferner der Wind auf die geneigte Sohle durch die Rohre *D* und *E* und ein zweiter regulirbarer Windstrom durch das Rohr *F* auf den Eisenherd *C* geleitet wird. — H. Dufrêné (D. P. 18483 vom

Fig. 8.

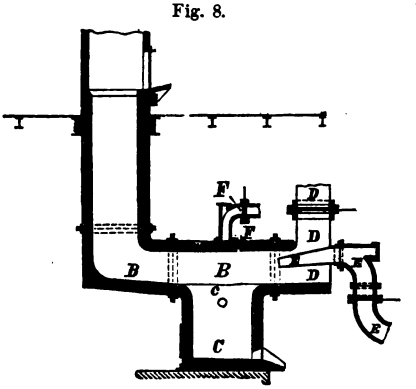

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Fig. 9.

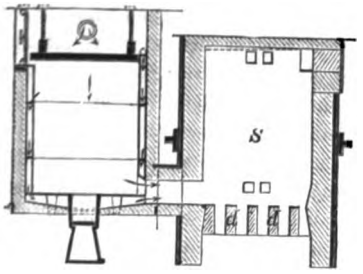

Fig. 10.

28. Mai 1881) bringt im unteren Teile des Schachtes *S*, unmittelbar über der Eintrittsöffnung der Feuergase einen aus gewölbten Rippen *d* bestehenden Zwischenboden an, welcher dazu bestimmt ist, das Schmelzmaterial zu tragen und die Flamme in das letztere eintreten zu lassen. Die Schmelzmaterialien werden bei Beginn der Ofenfüllung durch einen an Ketten hängenden Kasten *W* eingebracht. Derselbe wird bis auf den Zwischenboden herabgelassen und durch Anziehen der hinteren Kette in der Richtung des Pfeiles entleert.

Ein Verfahren zur Herstellung von Formplatten (D. P. 17925 v. 23. Juni 1881) von J. Brandt (Berlin) besteht darin, dass man von einem fertigen Gegenstand, der je nach seiner Beschaffenheit auf sog. falscher Unterlage in Formsand eingedrückt ist, einen Abguss in „Spence-Metall" nimmt. Die so hergestellte Hohlform überzieht man mit einer feinen Oelschicht und giesst wieder Spence-Metall in dieselbe, so dass man beim Erkalten dieses Eingusses ein genaues Modell erhält. Das Spence-Metall erleidet beim Erkalten keine Schwindung.

b. Fluss- und Schweisseisen.

Im verflossenen Jahre hat man sich vielfach und eingehend mit den chemischen und physikalischen Eigenschaften des Flussstahls beschäftigt. Von besonderem Interesse sind hier zunächst die Abhandlungen, die über die wichtige Frage der Entstehung, der Natur und der Bildungsverhinderung der Gaseinschlüsse in Flussstahl handeln. F. Müller*) schreibt bekanntlich die Entstehung von Hohlräumen in Stahlblöcken der Entbindung von Wasserstoff beim Festwerden des Metalls zu, da er ebenso wie Andere in einer Reihe von Untersuchungen als vorzüglichsten Bestandtheil sowohl der Gassecretionen als der intermolecularen Gaseinschlüsse eben dieses Gas gefunden hat (ca. 85 Proc. H und 15 Proc. N). Die günstige Wirkung eines Fernosiliciumzusatzes erklärt Müller durch die Annahme, dass Siliciumgehalt die Löslichkeit des Wasserstoffs im Stahle vermehrt. Dieser Wasserstoff-Absorptionstheorie traten auf dem vorjährigen Meeting des Iron & Steel Inst. ausser Pourcel u. A. auch Richards und Snelus entgegen. Ersterer sieht den Blasenbilder in Kohlenoxyd, entstanden durch Einwirkung gelösten Eisenoxyds auf den Kohlenstoff des Eisens; er nimmt an, dass ein Siliciumzusatz die Bildung von Kohlenoxyd durch Entstehen eines Silicats verhindert (Iron & Steel 1882 S. 509; St. u. E. 1882 S. 492). A. Ledebur (St. u. E. 1882 S. 591) glaubt, gestützt auf seine

*) Vgl. Techn.-chem. Jahrb. 1882 S. 56; St. u. E. 1882 S. 581.

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Untersuchungen (s. S. 11) und ausgehend von der Thatsache, dass flüssiges reines Eisen reichliche Mengen Wasserstoff zu lösen vermag, dass Wasserstoff wohl die Entstehung der Gasblasen veranlassen könne und ist ebenso der Ansicht, dass Silicium eine stärkere Neigung als Mangan habe, den Wasserstoff zu binden. Ebenso bekennt sich Brustlein (Compt. rend. d. l. Societé de l'Ind. min. Mars 1883) zu derselben Ansicht. Dagegen stellt sich H. Wedding (St. u. E. 1883 S. 199) vorläufig auf Pourcel's Seite. Er sagt, dass das Nichtvorhandensein von Kohlenoxyd in den Blasenräumen nicht beweise, dass Kohlenoxyd nicht trotzdem die Blasen erzeugt habe. Als entscheidenden Versuch betrachtet er den, nachzuweisen, ob mit Kohlenoxyd imprägnirtes Eisen nach dem Erkalten noch grössere Mengen davon erhält. Ad. Schmidt (Heidelberg) (Bg.- u. H. Ztg. 1883 S. 135) hält es für möglich, dass, verdrängt durch bei weiterer Abkühlung freiwerdenden Wasserstoff Kohlenoxyd durch das festgewordene, noch glühende Metall herausdiffundire.

Ueber die geeignetste chemische Zusammensetzung des Schienenstahls ist vielfach discutirt worden. Während auf der einen Seite manche Verteidiger für härteren Stahl auftreten, sprechen sich viele, wie Snelus (Meeting des Iron & Steel Inst.), Escalle (Bg.- u. H. Ztg. 1883 S. 79), J. T. Smith u. A. für Anwendung weichen Stahles aus. Pourcel empfiehlt Erhöhung des Mangangehalts, der Zähigkeit, Festigkeit, Widerstandsfähigkeit gegen Stosswirkung erzeuge, ohne Brüchigkeit hervorzurufen. Als passendste Zusammensetzung geben an

	Pourcel	Dudley	Snelus	Sandberg	
C =	0·45—0·5	0·33	0·35	0·3	Proc.
Si =	0·02	0·06	0·1	0·1—0·25	„
P =	0·08—0·1	0·07	unter 0·075	0·1	„
S =	0·05	—	—	0·05	„
Mn =	0·9—1·1	0·5	0·75	0·4—0·5	„

Es wird darauf aufmerksam gemacht, dass ein Stahl nach der Zusammensetzung Pourcel's und Dudley's schwer blasenfrei und jedenfalls theurer zu erlangen sei.

Was die mechanische Prüfung des Eisens und Stahls betrifft, so machte sich in den Kreisen der Eisenindustriellen eine Bewegung gegen die Zerreissprobe als Qualitätsprobe geltend. H. Brauns (St. u. E. 1883 S. 3) constatirt, dass es ihm aus einer grossen Reihe von Versuchen nicht gelungen ist, eine Uebereinstimmung nachzuweisen zwischen Zerreissproben und Betriebsresultaten, vielmehr übersteigt die Zahl der Widersprüche diejenige, die eine Uebereinstimmung zeigen. Ebenso wie E. Richards (St. u. E. 1882 S. 352) stellt er fest, dass verschiedene Bearbeitungsarten einen bemerkbaren Einfluss auf Festigkeit und Dehnung ausüben. Demgegenüber sagt Wöhler (Strassburg), dass keine der bekannten Prüfungsmethoden die Qualität des geprüften Stückes mit solcher Schärfe feststellt, wie die Zerreissprobe. Snelus, Sandberg u. A. sprechen sich für die Fallprobe als

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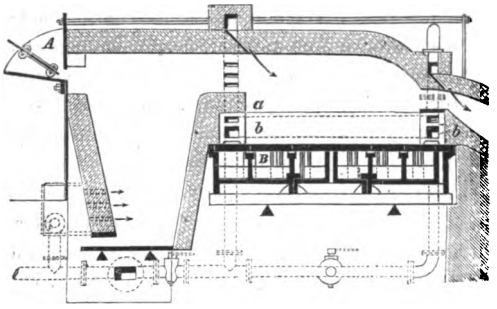
Prüfung des Schienenstahls aus. — A. Martens, über Qualitätsfeststellung von Stahl und Eisen (Zeitschr. d. V. dtsch. Ing. 1883 S. 51).

Aube's Steel and Gas-Compagnie in Paris (D. P. 17658 vom 20. August 1881) erzeugen Cementstahl von sehr gleichmässigem Kohlenstoffgehalt dadurch, dass der rohe Cementstahl unter Zutritt eines Stromes von trockenem Wasserstoffgas einer Temperatur von 600—700° in einer glasirten Retorte ausgesetzt wird.

Fig. 11.



Neuerungen an Flammöfen (D. P. 13193 vom 13. Juli 1880) von Ad. Chuchul bestehen erstens in der Anordnung eines zwei- oder mehrteiligen Füllkastens *A*, bei dem die auf der schrägen Mittelplatte herabgleitenden Kohlen selbst den Verschluss bilden, und zweitens in der Herstellung der Herdsohle aus einem drei- oder mehrteiligen Kasten *B*, der durch kupferne Kniestücke mit den durch die Feuerbrücken führenden Canälen *a* und *b* in Verbindung steht. (Fig. 11.)

Walzwerke.

Eine wichtige Neuerung beim Walzen von Gussstahlblöcken, die vielseitig Anerkennung gefunden, sind die Durchweichungsgruben (*soaking pits*) von J. Gjers, die bezwecken, unter Uebergehung des Erhitzens im Schweissofen den Block in seiner eigenen ursprünglichen Hitze zu walzen. Diese soaking pits sind verticale Gruben aus feuerfesten Ziegeln in dem Boden der Hüttenflur mit etwas grösserem Querschnitt und etwas höher als die Ingots. Der aus der Form gelöste Block wird direct in die vorgewärmte Gjers-Grube gebracht; nachdem er ca. $^1/_2$ Stunde in der gedeckten Grube gestanden, hat sich die Hitze in der ganzen metallischen Masse gleichmässig verteilt; der anfangs kirschrote Stahlblock ist weissglühend geworden und kann direct ausgewalzt werden. Die Gruben wirken als Wärme-Accumulator, je nach Bedarf Wärme abgebend und aufnehmend. Aus dem Blocke entwickeln sich in der Grube Gase, die nach mitgeteilten Analysen aus N, H und CO bestehen; der Stahlblock befindet sich also in einer Umhüllung von reducirenden Gasen, und wird dadurch der grosse Verlust durch Oxydation im Glühofen vollständig vermieden. Aus Untersuchungen von Stead geht hervor, dass für je 100 Calorien, die in einem auf die geeignete Temperatur zum Auswalzen erhitzten Stahl enthalten, 154 Calorien im flüssigen Stahle vorhanden sind. Der Gjers-Process, über den zuerst berichtet wird auf dem vorjährigen Meeting des Iron & Steel Institute in Wien, ist bereits

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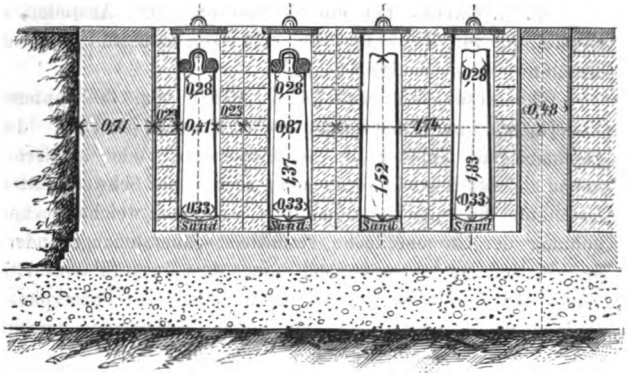
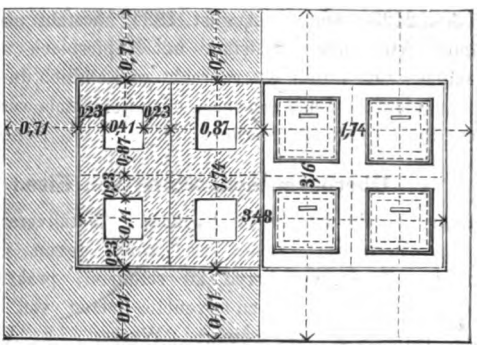
auf einigen amerikanischen und englischen Werken eingeführt. Er ist natürlich nur da anwendbar, wo der Betrieb continuirlich ist und die Ingots an Gestalt und Grösse nicht zu sehr wechseln. In Workington werden, nach einem Schreiben von Snelus an den Engineering, die aus der Gjers-Grube entnommenen Blöcke bis auf ca. 20 cm heruntergewalzt und dann wieder erhitzt. Die Ersparnis wird auf 5 M. pro Tonne fertigen Stahls angegeben. In jüngster Zeit hat Gjers eine modificirte Construction sich patentiren lassen: die Gruben befinden sich in einem von einem Eisenmantel umfassten Mauerwerk, das auf Rädern montirt ist.

Fig. 12 u. 13.

Längenschnitt



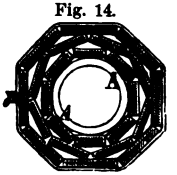
Grundriss.



Maasse in Metern

Eine von L. Murphy (D. P. 18246 vom 31. Juli 1881) angegebene Neuerung bei der Bildung von Schweisseisenpacketen bezieht sich auf die Anwendung eines röhrenförmigen Kernes *A*, Fig. 14, bei der Bildung von Schweisseisenpacketen, welche zum Auswalzen von Röhren, Säulen oder anderen hohlen Gegenständen bestimmt sind.

Fig. 14.



Ed. Daelen hat sich ein Universal-Walzwerk patentiren lassen, das zur Herstellung von Walzstäben mit rechtswinkligem Querschnitt dient. Die Caliber werden gebildet einmal durch die überragenden Köpfe der Wal-

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zen und dann durch Hülsen, die auf die Walzen geschoben mit diesen rotiren. Das Walzen geschieht also auf den vor den Ständern vorstehenden Walzenköpfen im Verein mit den Endflächen der Hülsen (St. u. E. 1883 S. 161).

R. M. Daelen hat eine Vorrichtung zum Anstellen der Walzen zur Herstellung von Blech und Universaleisen construirt mit direct wirkender Maschine (St. u. E. 1883 S. 335).

H. Reusch, Dillingen (D. P. 18251 vom 30. September 1881) giebt Neuerungen zur Herstellung von Panzerplatten durch Aufgiessen geschmolzenen Metalles auf schmiedeeiserne oder stählerne Unterlagen an, indem leichtflüssige Silicate oder Borate als Schweissmittel zwischen dem festen und flüssigen Metall benutzt und die weiche Deckplatte durch Entkohlung der Gussoberfläche vermittelst sauerstoffabgebender Substanzen vor dem Walzen ersetzt werden soll. Nach dem Zusatz-Patent 19154 vom 19. November 1881 soll die Entkohlung der stählernen Panzerplatte mittelst sauerstoffabgebender Körper nicht nur auf der Aussenseite derselben, sondern auf der ganzen Oberfläche vorgenommen werden.

Ein Verfahren der Württemberger Metallwaarenfabrik Geislingen zur Herstellung von kupferplattirtem Eisen- und Stahldraht (D. P. No. 21230 vom 6. August 1882) besteht darin, dass die vorher gereinigten Eisen- oder Stahlstäbe mit Kupferblech umhüllt, alsdann unter Luftabschluss zum Rotglühen gebracht und endlich durch Walzen oder Ziehen, ohne Hinzufügung eines Schweiss- oder Lötmittels vereinigt und auf die gewünschte Stärke gebracht werden.

c. Oberflächenbehandlung von Eisen und Stahl.

Barff & Bower*) und Ledebur, (Metallverarbeitung 1882 S. 270) haben ihr Verfahren, Eisen und Stahl gegen Oxydation durch eine Schicht von Eisenoxyduloxyd zu schützen, praktisch ausgebildet. Die Société d'inoxidation hat zu Grenelle Oefen von 3 cbm Inhalt gebaut und ist das Patent von einigen Werken, u. A. von der Friedrich-Wilhelm-Hütte zu Mühlheim angekauft. Die Kosten sollen pro 100 kg 0·90 Frcs. nicht übersteigen. Schmiedestücke müssen vor der Inoxidation bearbeitet und vollendet sein, da bei nachträglichem Bearbeiten die Oxydschicht leidet, was bei Gusseisen durchaus nicht der Fall sein soll. Operationsdauer 3—6 Stunden bei 400—1500 kg Gusseiseneinsatz; Brennstoffverbrauch pro 24 Stunden 500—600 kg fette Kohlen; bei 400—800 kg Stahl- oder Schmiedeeisen-Einsatz Dauer 3—7 Stunden bei Kohlenverbrauch pro 24 Stunden von 800—900 kg. — Ein Verfahren zur Emaillirung von Eisenguss-Gegenständen von Otto Hoerenz in Bernsdorf (D. P. 21263 vom 16. August 1882) bezweckt die Herstellung einer graphitfreien Schicht auf den Eisenguss-Gegenständen, um dieselben besser emailliren zu können. Die Gussform wird mit Schwefel allein oder in Verbindung mit Quarzpulver

*) Techn.-chem. Jahrb. 1883, S. 31.

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oder Holzkohlenstaub überzogen. Der Schwefel verbindet sich mit dem Graphit des Roheisens zu Schwefelkohlenstoff, der sofort verbrennt. Ebenso kohlenstoffentziehend wirken Petroleum oder Oel. Auch fertigen Gussstücken soll behufs Emaillirung der Graphit entzogen werden können, indem man sie mit Schwefelsäure von 60° B. oder mit Petroleum oder Oel bestreicht und dann glüht. — O. Leonhardt (Glaser's Ann. 1882 No. 131) über das Verzinken. — A. Neujean (Bg.- u. H.-Ztg. 1882 S. 360) benutzt beim Verzinken des Eisens statt eiserner Pfannen für kleinere Gegenstände Gefässe von feuerfester Masse und für grössere Flammöfen zum Einschmelzen des Zinks; die Sohle des letzteren besteht aus Coksasche, Abfällen feuerfester Producte und Rotthon.

Ad. Görz.

Statistik.

Im Deutschen Reich betrug in metr. Centnern ausgedrückt die

Waarengattung	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an Roheisen aller Art	2 829 585	2 819 725	1 869 385	2 009 570
„ Brucheisen und Eisenabfällen ausser Hammerschlag etc. .	80 484	83 856	593 153	554 485
„ Luppeneisen, noch Schlacken enthaltend; Rohschienen, Ingots	6 832	6 497	329 575	393 641
„ schmiedbarem Eisen in Stäben mit Einschluss des façonnirten	157 791	150 646	1 443 975	1 470 034
„ Radkranzeisen, Pflugscharen-eisen	384	512	140 522	162 134
„ Eck- und Winkeleisen . . .	1 994	1 839	36 956	57 455
„ Eisenbahnschienen	6 629	12 871	1 860 538	1 908 293
„ Eisenbahnlaschen, Unterlagsplatten u. eisernen Schwellen	1 730	1 225	115 961	152 655
„ an rohen Platten und Blechen aus schmiedbarem Eisen .	31 564	31 328	442 042	489 306
„ Weissblech (verzinntem Eisenblech)	27 537	26 474	4 384	3 685
„ polirten, gefirnissten, verkupferten etc. Platten und Blechen aus schmiedbarem Eisen	253	271	15 337	12 545
„ Eisendraht, auch verkupfert, verzinnt, verzinkt etc. . . .	34 801	33 203	2 274 156	2 320 182
„ ganz groben Eisengusswaaren	40 419	38 981	186 174	193 214
„ Eisen zu groben Bestandteilen von Maschinen und Wagen roh vorgeschmiedet	2 366	2 952	23 991	21 927

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Waarengattung	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an eisernen Brücken und Brückenbestandteilen	98	105	55 385	96 787
„ Ankern und Ketten	10 274	9 559	6 692	6 586
„ Drahtseilen	736	869	8 067	9 155
„ Eisenbahnachsen, Eisenbahnradeisen, Eisenbahnrädern, Puffern	2 397	5 172	118 227	117 573
„ Kanonenrohren, Ambosen, Schraubstöcken, Winden, Hackennägeln, Schmiedehämmern etc.	3 107	3 430	61 725	57 175
„ an gewalzten und gezogenen Röhren aus schmiedbarem Eisen	7 339	6 581	173 798	168 465
„ Drahtstiften	234	242	238 770	262 845
„ groben Eisenwaaren, anderen	77 244	76 332	598 754	587 116
„ feinen Eisenwaaren mit Ausnahme von Nähnadeln, Schreibfedern, Uhrfournituren und Gewehren	7 621	7 712	64 823	67 480
„ Eisenerzen, Eisen- und Stahlstein	7 831 766	8 662 366	16 211 818	17 513 595

II. Aluminium, Mangan, Nickel, Chrom, Wolfram.

Ueber die mechanischen Eigenschaften des Aluminiums machte W. H. Barlow auf der Versammlung der British Association einige erwähnenswerte Mitteilungen. Er stellte eine Barre von 3 Fuss Länge $^1/_4$ Qu. Zoll Querschnitt her und prüfte dieselbe auf Widerstand gegen Zug, Torsion und Druck, auf Ductilität, den Elasticitätsmodulus und die Grenzen der Elasticität. Die Resultate zeigen, dass das Gewicht eines Cub. Zolls 0·0972 Pfund (1 cbcm = 2·688 g) beträgt. Der Elasticitätsmodulus ist 10 000. Die Dehnbarkeit von 2 Zoll langen Stücken war nicht beträchtlich. Unter Berücksichtigung des Gewichts ergab sich für die Zähigkeit oder den Widerstand gegen Zug ein mechanischer Wert, der nahezu gleich kam dem eines Stahls von 5 500 kg pro qucm Widerstandsfähigkeit gegen Zug. Seine Ausdehnung innerhalb der Elasticitätsgrenzen ist ungefähr 3 mal so gross wie die des Stahls und 5 mal so gross, wie die einer Eisenstange. Das Aluminium ist freilich noch recht teuer, aber da, wo Widerstandsfähigkeit des Materials zu-

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sammen mit Leichtigkeit und grosser Elasticität erforderlich ist, wird es auch jetzt schon mit Vorteil gebraucht werden.

Auch J. W. Mallett hat die Eigenschaften des reinen Aluminiums untersucht. Das reine Metall wurde bereitet durch Umwandlung von Handelsaluminium (96·89 Al, 1·84 Fe, 1·27 Si, Spur Cu) in das Bromid. Mehr als 2 kg desselben wurden durch fractionirte Destillation gereinigt. Dies wurde wiederholt, bis das Product völlig farblos war und sich ohne Rückstand in Wasser löste. Die Reduction war natürlich schwierig und mit Verlust verbunden; sie wurde mit Hilfe von Natrium in einem Tiegel ausgeführt, der aus einer Mischung von Thonerde und Natriumaluminat hergestellt war. Die erhaltenen ziemlich grossen Aluminiumkügelchen wurden auf einer Unterlage von Thon umgeschmolzen, dann kurze Zeit in Salzsäure gelegt, gewaschen und getrocknet. Das so gereinigte Aluminium ist viel weisser als das des Handels, beinahe zinnweiss, ohne Stich in's Blaue. Der Metallglanz einer frischen Schnittfläche ist stärker als bei Zinn. Das reine Metall ist auch weicher und hämmerbarer als das Handelsproduct. Das Vol. Gew. bei 4°, bezogen auf Wasser von derselben Temperatur ist 2·583. Die specifische Wärme ist 0·2253 für Temperaturen zwischen 0 und 100°. Diese Zahl, multiplicirt mit dem Atomgewicht giebt die Atomwärme 6·09.

J. Morris in Uddingston hat ein Verfahren zur Fabrikation von Aluminium patentirt. (Engl. P. 1058 vom 4. März 1882.) Der Erfinder glaubt Aluminium dadurch erhalten zu können, dass ein inniges Gemisch von Thonerde und Kohle in einer Retorte geglüht wird, während Kohlensäuregas hindurchgeleitet wird. Das durch Einwirkung der Kohle auf dasselbe entstehende Kohlenoxyd soll die Thonerde zu Aluminium reduciren.

Nach dem D. P. 22150 von Morris wird eine Aluminiumchloridlösung mit Holzkohlenpulver und Russ gemischt. Nach der Abdampfung, bei welcher das Chlor als Chlorwasserstoffsäure entweicht, wird die Masse zu Kugeln geformt, welche zunächst getrocknet und dann zur Entfernung der letzten Reste von Chlor in stark erhitzten Röhren einem Dampfstrome ausgesetzt werden. Die Kugeln werden dann durch Erhitzen unter Luftausschluss von dem freien und gebundenen Wasser befreit und dann etwa dreissig Stunden lang mit Kohlensäure bei fortgesetzter Erhitzung behandelt. Das durch Einwirkung der Kohlensäure auf die Kohle entstandene Kohlenoxyd soll die Thonerde zu Aluminium reduciren. Das Metall wird in Form einer schwammartigen Masse erhalten, wird unter Zusatz von Kryolith oder Kochsalz zusammengeschmolzen und soll noch einem dem Bessemer-Process ähnlichen Läuterungsverfahren unterworfen werden.

George Scott in London. Fabrikation von Manganlegirungen. (Engl. P. 620 vom 8. Februar 1882.) Um Spiegeleisen und Ferromangan herzustellen, werden Braunstein, titanhaltiger Eisensand von Taranaki in Neuseeland (an Stelle von gramulirtem Eisen) und Kohle in geeigneten Verhältnissen im Graphittiegel zusammengeschmolzen.

L. Guétat und Fr. Chavanne in St. Chamond. Herstellung von Chrom-

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eisen, Wolframeisen und Phosphorkupfer. (D. P. 21902 vom 3. August 1881.) Ein neutrales Alkali- oder Erdalkali-Chromat wird mit Eisenchlorür- oder Eisenvitriollösung vermischt und der Niederschlag ausgewaschen. Das Eisenchromat wird dann mit Kohle vermischt und in Tiegeln auf Weissglut erhitzt. In analoger Weise wird Wolframeisen dargestellt. Phosphorkupfer wird aus Kupferphosphat, das durch Fällen von Kupferchlorid und dreibasischem Calciumphosphat erhalten ist, dargestellt.

P. C. Gilchrist und S. G. Thomas in London raffiniren Nickel in folgender Weise. (Engl. P. 1690 vom 8. April 1882.) Rohnickel wird geschmolzen, und in die geschmolzene Masse werden Luftströme injicirt, bis alles Eisen und andere Verunreinigungen oxydirt sind. Die Operation wird in einem dem Bessemer-Converter ähnlichen Apparat ausgeführt. Schlackenbildende Stoffe, wie Kalk oder Kieselsäure, werden zugesetzt. Das Futter des Ofens kann sauer oder basisch sein.

In Oregon sind ausgedehnte Lager von Nickelerzen aufgefunden worden. Vorkommen und Zusammensetzung des Erzes gleicht dem des neucaledonischen Garnierits und Numeits.

Nach Ernst (Oesterr. Zeitschr. f. Berg- u. H. Wesen 1882, S. 23) wird das nach dem Fleitmann'schen Verfahren*) hergestellte Schmiednickel im Münzwesen gebraucht. Die Schweiz prägt z. B. 20-Centimstücke aus chemisch reinem Nickel.

Zur Darstellung von metallischem Wolfram und Wolframlegirungen werden nach C. J. L. Leffler in Sheffield, Engl. P. 3522 vom 25. Juli 1882, Wolframoxyde und Kohle schichtenweise in einen Ofen gebracht, der so construirt ist, dass während des Glühens Luft keinen Zutritt in das Innere desselben haben kann.

III. Zink.

Der krystallinische Zustand der Metalle. Hierüber schreibt S. Kalischer in Dingl. pol. Journ. 246, S. 486: Wenn gewalztes Zink auf 150 bis 170° erhitzt wird, so erleidet es Veränderungen, während das Aussehen dasselbe bleibt. Es verliert den hellen Ton und wird fast klanglos. Es kann leichter gebogen werden, bricht leicht und giebt beim Biegen einen dem Zinngeschrei ähnlichen Ton. Diese Veränderungen rühren davon her, dass die Structur des Zinks krystallinisch wird. Um dies zu vermeiden, soll bei Herstellung des Walzzinns die Temperatur nicht höher als 130° sein. Cadmium- und Zinnblech werden bei 200° krystallinisch. Eisen- und Kupferblech können auch krystallinisch gemacht werden, nicht Stahlblech. Gewalztes Blei ist krystallinisch, Feinsilber und Gold nicht. Der Verfasser meint, dass der krystallinische Zustand der Metalle der natürliche sei, der durch mechanische Einwirkungen, häufig auch durch Wärme beseitigt werden kann.

*) Vgl. Techn.-chem. Jahrb. 1882, S. 74; 1880, S. 80.

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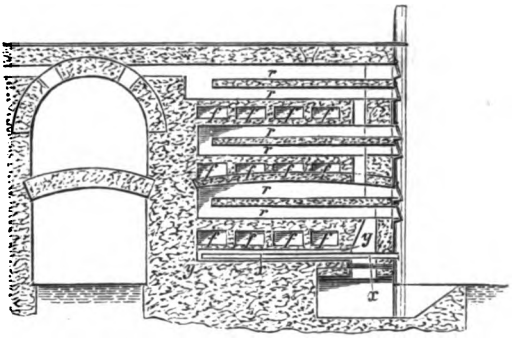
Violle hat den Siedepunkt des Zinks zu 930° bestimmt (Compt. rend. 94, S. 720).

Zinköfen. — Ein von K. Eichhorn und M. Liebig in Letmathe construirter Ofen zum Rösten von Zinkblende (D. P. 21032 vom 2. Mai 1882) (Fig. 15) hat Aehnlichkeit mit den Maletra'schen Kiesröstöfen. Derselbe besteht aus einer Anzahl Kammern *r*, welche durch die einem Generator entnommenen, die Feuerzüge *f* durchstreichenden Feuergase von aussen geheizt werden. Um die Wärme in den langgestreckten Feuerzügen genügend verteilen zu können, wird erwärmte Verbrennungsluft an drei verschiedenen Stellen den Generatorgasen durch besondere Luftcanäle zugeführt. Das Erz wird allmälig von der obersten Sohle *r* auf die unterste gebracht. Die vollständige Abröstung gelingt nur dadurch, dass die Röstluft in dem Rohre *x* und dem Canal *y* sehr stark erhitzt wird.

Fig. 15.



Um oxydische Zinkerze zu reduciren hat Gustav Mauritz Westman in Karis, Finnland, folgende Ofenanlage patentirt (D. P. 19127 v. 6. Nov. 1881). Angenommen, das Zink sei in dem einen Ofen *a*, (Fig. 16, folg. S.) welcher mit abwechselnden Schichten von Erz und Kohle gefüllt ist, schon reducirt und verflüchtigt worden, so wird die in diesem Ofen noch zurückbleibende Kohle unter Einführung warmen Gebläsewindes bei *d* vergast und werden dann die Generatorgase auf dem Wege *e f g h* zu dem Gasventil *i* geführt. Von hier gehen die Gase durch die Röhre *k* zu dem Raume *l* des grossen Gasventiles *m*, um dann durch *o* nach dem linksseitigen Regenerator *p* geleitet zu werden. Letzterer liegt in Wirklichkeit dicht neben dem Ofen. Hier erwärmen sich die Gase und gehen durch *r t u' s* und *t* zu dem zweiten Ofen *b*. Dieser Ofen ist mit Erz und Kohle gefüllt. Die hier erzeugten Gase gehen mit den Zinkdämpfen vermischt durch die Röhren *e* und *f*, wobei die Zinkdämpfe sich condensiren und das Zink in die Kasten *g* abfliesst. Gleichzeitig wird der Gebläsewind, der um die Röhren *f* herumgeleitet wird, erwärmt. Die übrigen Gase treten bei *h* aus und gelangen durch das Ventil *i* und das Rohr *u*, den Condensator *v*, das Rohr *w* zum Ventil *m*. Von hier durchstreichen die Gase *z a'* und den rechtsseitigen Regenerator *p*, werden hier bei *b'* verbrannt und entweichen dann durch die Röhren *o d' e'* zur Esse. Der Gebläsewind durchstreicht die Röhren *f'*, geht, nachdem er sich, wie oben erwähnt, erwärmt hat, an der Innenseite der Oefen in das Rohr *o'*, Ventil *h'* und Rohr *i'* über und gelangt so zu den Düsen *d*. Der von der

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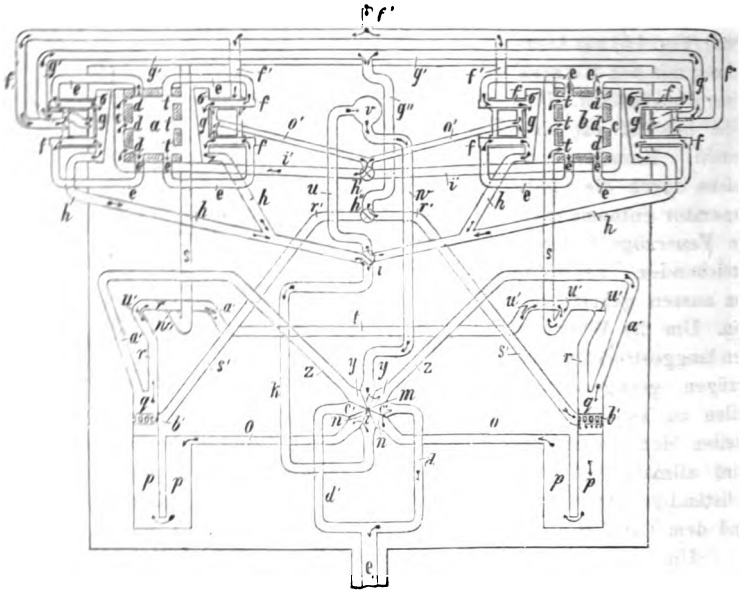
Aussenseite der Oefen kommende Wind geht durch g' g'', Ventil h'', Röhren r' und s' zu dem rechtsseitigen Regenerator p und trifft hier bei b'

Fig. 16.



auf die vom Ofen b kommenden Gase, verbrennt diese und heizt so diesen Regenerator, Das Zink sammelt sich in den vorn offenen Kasten g an, wo es abgeschöpft werden kann. Die Oefen besitzen Vorherde zur Entfernung der Schlacken etc.

Fig. 17.

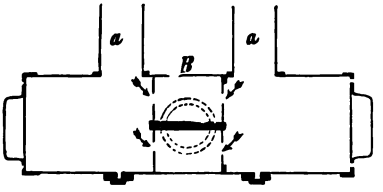
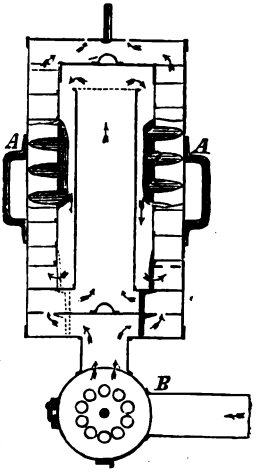


Fig. 18.



Ernst Mielchen in Siersza bei Trzebinia, Bezirk Chrzanow, Galizien, hat Neuerungen an Ballons für Zinkdestilliröfen angebracht (D. P. 18635 vom 20. November 1881). Der stehende Ballon A ist combinirt mit dem liegenden Ballon B und den beiden Röhren a, welche den Ballon mit je zwei Muffelvorlagen des Zinkofens verbinden. Der stehende Ballon A ist in mehrere Kammern geteilt, damit die zu condensirenden

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Gase einen möglichst langen (durch Pfeile angedeuteten) Weg machen müssen, bevor sie ins Freie treten. (Fig. 17 u. 18.)

Die Condensation von Zink-, Cadmium- und Bleidämpfen in Räumen, welche über den Schmelzpunkt genannter Metalle erhitzt sind, wird durch Einschieben eines von Guido Wolfram in Lipine erfundenen Kühlapparates (D. P. 21483 vom 25. Juli 1882) rasch bewirkt, welcher aus zwei in einander gesteckten Röhren besteht, deren Axen zusammenfallen. In das innere Rohr tritt vorn Wasser oder Luft ein, gelangt am hintern Ende in das weite Rohr und tritt aus diesem vorn wieder aus.

Hermann Schmidtmann in Leipzig. Verfahren zur Darstellung von Zinkoxyd (D. P. 21987 vom 9. April 1882). Zinkerze und Hüttenproducte, welche das Zink als Schwefelmetall oder schwefelsaures Salz enthalten und zum Verschmelzen zu geringhaltig sind, werden zerkleinert und die Sulfide in schwefelsaure Salze übergeführt. Nach der Auslaugung der Sulfate wird durch Zusatz von Magnesia oder kohlensaurer Magnesia das Zink als Oxyd bezw. Carbonat gefällt.

Statistik.

Im Deutschen Reich betrug, in metr. Centnern ausgedrückt, die

Waarengattung.	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
Waaren aus Aluminium, Nickel; feine Waaren aus Alfenide etc.	1 963	2 093	18 082	21 360
Rohes Zink, Bruchzink	43 954	48 822	561 624	584 004
Gewalztes Zink	1 479	891	142 698	165 997

IV. Kupfer.

Modificirter Hunt-Douglas-Process. Ein grosser Vorteil des Hunt-Douglas-Verfahrens liegt in dem geringen Verbrauch an Eisen zur Fällung des Kupfers, denn zu $^2/_3$ wird dieses als Chlorür Cu^2Cl^2 extrahirt; das als Chlorid in Lösung befindliche Drittel kann durch Behandlung mit Kupferstein in Kupferchlorür umgewandelt werden; auch die Abwesenheit von Eisenoxydverbindungen mindert den Verbrauch an Eisen herab; Silber geht als Chlorsilber in Lösung und kann durch Kupfer gefällt werden. Diesen Vorteilen stehen gewisse Nachteile gegenüber. Bei der Lösung des Kupfers aus den Erzen durch Eisenchlorid bildet sich viel Eisenhydroxyd, welches die Filter verstopft. Das in der Lauge enthaltene Silber wird erst dann durch Kupfer niedergeschlagen, wenn alles Kupferchlorid in Chlorür übergegangen ist, womit Zeitverlust und ein wegen der Schwerlöslichkeit des Kupferchlorürs grösserer Verbrauch an Lauge verknüpft ist.

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T. Sterry Hunt hat das Verfahren nun in folgender Weise modificirt und damit auf eine hohe Stufe der Vollendung gebracht.

Wenn schweflige Säure in eine Kupferchloridlösung geleitet wird, so schlägt sich fast alles Kupfer als Chlorür unter Bildung von Schwefelsäure und Salzsäure nieder:

$$2\,CuCl^2 + SO^2 + 2H^2O = Cu^2Cl^2 + 2\,HCl + H^2SO^4$$

Wenn schweflige Säure in eine Lösung gleicher Aequivalente von Kupferchlorid und Kupfervitriol tritt, so wird auch das Kupfer als Chlorür gefällt.

$$CuCl^2 + CuSO^4 + SO^2 + 2H^2O = Cu^2Cl^2 + 2H^2SO^4.$$

Kupferchlorür nimmt aus der Luft Sauerstoff auf, und schweflige Säure verwandelt das Oxychlorid wieder in Kupferchlorür:

$$Cu^2Cl^2 + O = CuCl^2, CuO$$

$$CuCl^2, CuO + SO^2 + H^2O = Cu^2Cl^2 + H^2SO^4.$$

Diese Reactionen finden neben einander statt, wenn Luft und SO^2 durch Wasser streichen, in welchem Kupferchlorür suspendirt ist.

In der Praxis wird nun zu der Kupfersulfatlösung, die man durch Auslaugen gerösteter Kiese oder oxydischer Erze mit Schwefelsäure erhält, so viel Kochsalz gesetzt, dass auf 2 Mol. Kupfersulfat etwas mehr als 1 Mol. Chlornatrium kommt. Dann wird schweflige Säure eingepresst. Ein Ueberschuss davon wird durch einen Teil ursprünglicher Lösung oxydirt. Die vom gefällten Kupferchlorür abgezogene Flüssigkeit dient zum Extrahiren von Erzen und Hüttenproducten. Weil dieselbe noch ein wenig Kupferchlorür enthält, so bleibt Silber als Chlorsilber neben Bleisulfat beim Rückstand. Etwa im Erz enthaltene Oxyde von Zink, Nickel und Kobalt gehen mit dem Kupfer in Lösung, werden aber durch schweflige Säure nicht niedergeschlagen. Das Kupferchlorür kann durch Kochen mit Kalkmilch in Oxydul übergeführt werden, das dann zu Garkupfer verschmolzen wird. Oder das Kupferchlorür wird mit Wasser bedeckt und durch Eisen zu Kupfer reducirt. Die Eisenchlorürlösung kann dann an Stelle des Kochsalzes zur nächsten Kupfersulfatlösung zugesetzt werden. (Bg.- u. h. Ztg. 41 S. 315.)

Nach R. Flechner werden in Balan, Siebenbürgen, die Kupferkiese folgendermaassen extrahirt. Das Rohmaterial von etwa 2 Proc. Kupfergehalt wird vorgeröstet und zerkleinert. Dann wird dasselbe mit Eisenvitriollauge von 4 bis 6° B. zu einem Brei angerührt und in grossen Haufen einige Tage sich selbst überlassen. Das gebeizte Material wird in Gasöfen calcinirt. Das Glühproduct wird mit verdünnter Eisenvitriollauge von 2 bis 4° B. bei 30 bis 40° extrahirt. Die bläulich-grüne Flüssigkeit enthält im Liter 250 bis 300 g Vitriolsalze. Die Masse wird 9 bis 10 mal ausgewaschen. Ein Teil der Lauge wird bis zur Krystallisation von Kupfervitriol eingedampft; aus dem grösseren Teil aber wird mit Eisenabfällen Cementkupfer gefällt. Die entkupferte Eisenvitriollauge wird wieder zum Beizen und Auslaugen benutzt. (Dingl. pol. J. 243 S. 462.)

Sein Verfahren, Kupferleche in der Bessemerbirne zu ver-

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blasen*), hat P. Manhes in Lyon nach dem D. P. 18900 vom 26. März 1881 dahin vervollkommnet, dass unterhalb des Niveaus der Düsenausmündungen ein beckenartiger Raum angeordnet wird, so dass Wind in die geschmolzene Masse eingeblasen werden kann, ohne dass dabei das schon reducirte Metall von dem Winde getroffen wird.

A. Tamm beschreibt die Kupfersteinverhüttung in der Bessemerbirne, wie sie nach dem Verfahren von Manhes in den Kupferwerken von Eguilles und Vedènes ausgeführt wird. (Bg.- u. h. Ztg. 1882 S. 180.)

A. M. G. Sébillot in Paris verarbeitet Erze nach dem Engl. P. 1913 vom 21. April 1882 in folgender Weise: Die Erze werden fein gepulvert; wenn Sulfide vorhanden sind, nach vorhergehender Calcination. Die Erze werden dann in Sulfate umgewandelt. Dies geschieht in einem Canalofen mit doppelter Wölbung. Am einen Ende seitwärts ist die Feuerung, am andern der Schornstein. In diesen Ofen wird, der Feuerung entgegen, eine Anzahl gusseiserner auf Schienen laufender Wagen eingeschoben, welche das Erzklein und die erforderliche Menge Schwefelsäure enthalten. Die Flamme ist durch die untere Wölbungswand von der Masse getrennt. Oberhalb eines jeden Wagens wird die Wölbung von einer Röhre durchbrochen, welche die schweflige Säure in eine Bleikammer führt. Wenn ein Wagen am Feuerungsende ausgezogen werden kann, wird am andern Ende ein Wagen mit frischer Füllung nachgeschoben. Die Sulfate werden dann ausgelaugt. In Lösung gehen wesentlich Eisen- und Zinksulfat; gelöstes Kupfer wird durch Eisen gefällt, so dass in dem Rückstand alles Kupfer, Silber, Gold und Bleisulfat enthalten ist. Dieser wird wie vorhin mit Schwefelsäure behandelt, und aus dem schliesslichen Rückstand wird das Gold durch Amalgamation gewonnen. Zink- und Eisensulfat werden zur Trockne gebracht und calcinirt. Die harten porösen Oxyde werden in einem besonders construirten Schachtofen mit Kohlenoxyd oder in einem gewöhnlichen Puddelofen zu Metall reducirt.

Farnham Maxwell Lyte in London hat folgendes Verfahren, antimonhaltige Erze chlorirend zu rösten, angegeben (D. P. 22131 vom 20. Mai 1882). Wenn man Erze, welche Blei, Silber, Kupfer oder Nickel und Antimon oder Arsen enthalten, mit Kochsalz röstet, so entweichen bei der hohen Rösttemperatur neben dem Chlorantimon etc. auch Dämpfe von Chlorsilber und Chlorblei. Um diesen Verlust zu vermeiden, setzt man die gerösteten oder ungerösteten Metallsulfide in einem Flammofen oder einer Muffel der Einwirkung von Chlorwasserstoffsäure bei einer Temperatur von 250—400° C. aus. Die weniger flüchtigen Chloride des Silbers und Bleies bleiben vollständig zurück, während Chlorantimon entweicht, dessen Dämpfe mittelst einer Salzlösung condensirt werden. Aus der Lösung wird durch Eisen oder Zink metallisches Antimon abgeschieden. — Mittelst heisser Kochsalzlösung werden Chlorblei und Chlorsilber ausgelaugt; beim Erkalten

*) Techn.-chem. Jahrb. 1883, S. 40.

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scheidet sich Chlorblei zum Teil krystallinisch ab. Aus der abgegossenen Flüssigkeit werden das Silber und die Reste des Bleies durch Zink als Metalle gefällt und beide auf bekannte Weise getrennt.

Juan Francisco N. Macay in Charapoto, Ecuador, hat folgende Apparate zur Verarbeitung von Erzen nach seinem Verfahren*) angegeben (D. P. 17086 vom 12. Juni 1881). Das gepulverte Erz und die Lösungsmittel kommen in den horizontalen drehbaren Cylinder *A*, (Fig. 19) der zweckmässig aus hartem Holz hergestellt ist. Der Deckel A^2 enthält vier Mannlöcher *H*, deren Deckel mit Gummi abgedichtet sind, und eine centrale Oeffnung *H'*, welche nach Bedarf freigegeben wird, um das Entweichen von Luft und Gasen zu gestatten. Innerhalb des Cylinders *A* befindet sich ein polygonaler Behälter *B* (Fig. 20), dessen Dauben durch die Hohlringe *C* gestützt werden. Zwischen

Fig. 19.

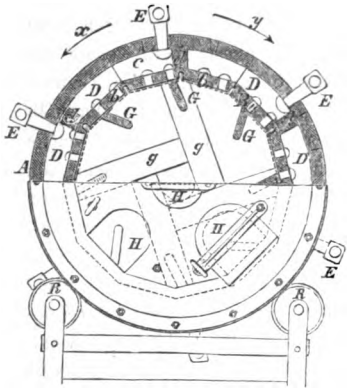
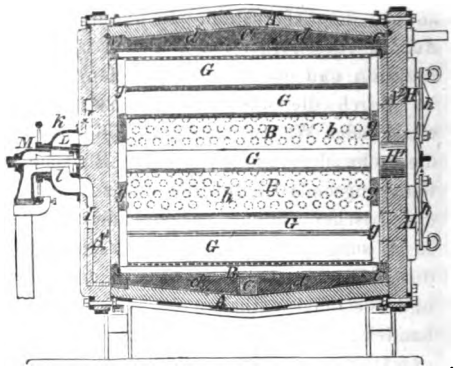


Fig. 20.



A und *B* befindet sich ein Raum, welcher durch die dem Cylinder entlang laufenden Scheidewände *d* in Abteilungen *D* geteilt wird. Jede Abteilung ist mit einem Ablasshahn *E* zur Entfernung der filtrirten Flüssigkeit versehen. Der Behälter *B* ist mit Durchbohrungen *b* versehen und auf der inneren Fläche mit Asbesttuch oder einem anderen Filtrirstoff überzogen. *G* sind schräge Leisten, welche durch die Arme des Endgestells *g* getragen werden. Wenn der Cylinder in der Richtung *x* gedreht wird, so fallen die Substanzen von der einen Leiste auf die andere, so dass das Asbesttuch nicht beschädigt wird. Bei fein gemahlenen Stoffen wird der Cylinder in der Richtung *y* gedreht. Die festen und flüssigen Stoffe werden dann durch die Leisten hoch genommen und fallen in einiger Entfernung nach unten.

Der Deckel *A'* ist mit Radialcanälen *I* versehen, welche ein Verteilungsventil mit je einer Abteilung *D* in Verbindung setzen. In die Ventilhülse *K* ist der Hahn *L* eingeschliffen, der durch das Handrad so gestellt werden kann, dass eine Oeffnung *l* mit einem bestimmten Canal *I* und der entsprechenden Kammer *D* in Verbindung gebracht wird. Durch den Stutzen

*) Techn.-chem. Jahrb. 1882, S. 86.

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M können Dampf, Wasser oder andere Flüssigkeiten eingeführt werden, welche die Filtrirfläche immer rein erhalten.

Der Cylinder wird auf den ausgekehlten Rollen *R* gedreht.

Neuerungen im Rösten von Sulfiden giebt Rob. Mackenzie in La Puebla de Guzman, Prov. Huelva (Engl. P. 4418 vom 11. October 1881) an. Der Ofen wird oben continuirlich gefüllt und das abgeröstete Erz unten aus zwei seitlichen geneigten Ansätzen abgezogen. Das Rösten soll durch Zutritt von Dampf beschleunigt werden. Zu dem Ende befindet sich auf dem Boden des Ofens ein flacher Behälter, der durch eine die Ofenwand durchsetzende Röhre mit Wasser gefüllt wird. Durch die Rösthitze wird dieses verdampft. Die Röstgase werden oben durch Canäle und weiter durch einen Regenturm hindurch abgezogen.

E. A. Parnell in Swansea. Gewinnung von Metallen aus Erzen. (Engl. P. 2715 vom 9. Juni 1882.) Das Patent bezieht sich auf die Behandlung des Schmelzproductes edelmetallhaltiger Pyrite. Dasselbe wird mit Salzsäure behandelt, welche nur das Schwefeleisen zersetzt. Die unlöslichen Kupfer-, Blei-, Silber- und Gold-Sulfide werden dann in gewöhnlicher Weise behandelt. Oder als Lösungsmittel wird Eisenchlorid gebraucht. Dabei gehen Eisen und Kupfer als Chlorüre in Lösung, und Schwefel scheidet sich ab. Bleisulfid geht in Bleichlorid über, welches grösstenteils ungelöst zurückbleibt. Die gebrauchte Lösung wird nach Ausfällung des Kupfers wieder zu Eisenchlorid oxydirt.

David Watson in Manchester reinigt Kupferniederschläge und Erze nach dem Engl. P. 1305 vom 17. März 1882, indem das gefällte Kupfer oder die Erze mit Lösungen von Alkalihydraten, -sulfhydraten oder -carbonaten erhitzt wird. Dadurch werden Arsen, Phosphor, Zinn und Chlor entfernt.

A. Tamm berichtet über die Aufarbeitung der kupferhaltigen Kiesabbrände in England. (Bg.- u. Hüttenm. Ztg. 1882, S. 232.) Die gerösteten Erze halten in Widnes, Glasgow u. s. w. 4 bis $4^1/_2$ Proc. Cu und 3 bis 4 Proc. S, in Newcastle 5 bis 7 Proc. S. Man röstet das Erz, dessen Schwefelgehalt event. durch Zusatz von Erzschlieg auf 5 Proc. gebracht wird, mit 12 bis 18 Proc. Kochsalz in Muffelöfen von 10 bis 18 m Länge. Die Gase gehen durch Cokstürme zur Gewinnung von Salzsäure, welche dann zum Auslaugen des Röstgutes hinreicht. Aus den Laugen wird das infolge der Gegenwart von Kochsalz gelöste Chlorsilber als Jodsilber gefällt, das Kupfer metallisch mittelst Schmiedeeisenabfall. Das erhaltene Silber soll 1 bis 1·5 Proc. Gold enthalten. Der Auslaugerückstand, ziemlich reines Eisenoxyd, dient zur Darstellung von Bessemerroheisen.

Für die elektrochemische Behandlung von Kupfer-, Nickel-, Blei-, Quecksilber-, Silber-, Golderzen etc. werden nach Nic. Em. Reynier in Paris (D. P. 19142 vom 28. April 1881) Elektrolyte mit Aetznatron oder -Kali als Base angewendet. Zink oder Blei in galvanischen Elementen werden durch ein leitendes reiches oder angereichertes Zink- oder

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Bleierz ersetzt und es wird eine alkalische Flüssigkeit angewendet. Die Elektrolyte werden durch einen Strom Kohlensäure oder Chlor oder Schwefelwasserstoff regenerirt, indem das Blei- oder Zinkoxyd als Carbonat, Chlor- oder Schwefelverbindung gefällt wird, oder indem durch Fällung mit kohlensaurem Alkali das fehlende Alkaliäquivalent ersetzt wird.

Das Verfahren wird in porösen, vielfachen, communicirenden Gefässen aus Papier, Gewebe, Filz, Häuten, Membranen oder anderen biegsamen Scheidewänden, welche ähnlich wie Papierfilter durch mehrfache Faltungen entstehen und doppelt, vier-, achtfach u. s. f. gemacht und in einander greifend angeordnet werden können, ausgeführt.

Fig. 21.

Fig. 22.

In Fig. 21 ist ein solches Gefäss mit angedeuteten Elektroden *c u* und *z n* und in Fig. 22 sind zwei in einander greifende Gefässe gezeigt.

Legirungen. Phosphor und Eisen enthaltende Kupfer-Zinn- und Kupfer-Zink-Legirungen mit oder ohne Zusatz von Blei stellt G. Alex. Dick in London (D. P. 18603 vom 9. December 1881) folgendermaassen dar: Das Eisen wird den Legirungen nur in Form von Phosphoreisen (mit 5—50 Proc. Phosphor) oder als Verbindung von Phosphoreisen mit einer Kupfer-Zinn- oder Kupfer-Zink-Legirung zugesetzt. In letzterem Falle schmilzt man 1 Tl. Eisen mit 1—2 Tln. Phosphor-Kupfer oder -Zinn, oder eisenhaltiges Zink (mit 3—20 Proc. Eisen) mit Phosphor-Kupfer oder -Zinn zusammen und setzt diese Legirung zu 2 Tln. Kupfer, welches mehr oder weniger Zink enthält. Niemals soll der Eisengehalt der fertigen Legirung 10 Proc., der Phosphorgehalt 3 Proc. übersteigen. Soll der Phosphor in dem Metallbad gelöste Oxyde reduciren, so muss die Zusatzlegirung einen entsprechend höheren Phosphorgehalt besitzen. Für Lagermetall wird ein Zusatz von 2—10 Proc. Blei zu den obigen Legirungen für zweckmässig gehalten.*)

Siliciumhaltiges Kupfer wird nach dem Engl. P. 1821 vom 17. April 1882 von L. Weiller in Angoulème dargestellt, indem ein Gemisch von 22·5 bis 45 Gwt. Fluorkieselkalium, 30 bis 60 Glaspulver, 12·5 bis 25 Kochsalz, 5 bis 10 Soda, 6 bis 12 Kalk, 25 bis 50 Chlorcalcium in geschmolzenes Kupfer oder Bronze eingetragen wird. Es soll angeblich in der hohen Temperatur durch zunächst entstehendes Natrium Silicium in Freiheit gesetzt werden, welches sich mit dem Kupfer verbindet. (Vgl. auch Weiller's D. P. 20667 vom 19. April 1882.)

G. A. Dick in London, stellt nach dem Engl. P. 2484 vom 25. Mai 1882 Legirungen von Kupfer, Zink und Eisen her, indem das Eisen zunächst in bestimmten Verhältnissen mit dem Zink legirt wird, da geschmolzenes Zink bis zu 5 Proc. Schmiedeeisen auflöst. Oxyde in diesen Legi-

*) Vgl. Techn.-chem. Jahrb. 1883, S. 41.

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rungen werden durch Zusatz von Mangankupfer entfernt. Dabei kann noch mehr Mangan eingeführt werden, als zur Reduction der Oxyde erforderlich ist.

Statistik.

Kupfergewinnung in den Vereinigten Staaten. Von der „Arizona Copper Company“ in Edinburgh wurde festgestellt, dass während der 11 Jahre von 1872 bis 1882 die Kupfergewinnung in den Vereinigten Staaten folgende Ziffern aufweist.

Jahr	Menge in Pfd.	Jahr	Menge in Pfd.
1872	28 000 000	1878	43 000 000
1873	31 000 000	1879	46 000 000
1874	34 000 000	1880	57 000 000
1875	37 000 000	1881	70 000 000
1876	40 000 000	1882	88 000 000
1877	42 000 000		

Der Verbrauch an Kupfer stieg in derselben Zeit von 34 000 000 Pfd. in 1872 auf 77 000 000 Pfd. in 1882. Eine grosse Zunahme im Verbrauch zeigt sich von 1880 an mit 62 000 000 Pfd. Diese Zunahme ist eine Folge der Entwickelung, welche die elektrische Beleuchtung erfahren hat.

Im Deutschen Reich betrug, in metr. Centnern ausgedrückt, die

Waarengattung	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an Kupfer, roh oder als Bruch	105 786	125 171	60 965	63 121
„ Quecksilber	3 959	4 256	61	68
„ Kupfer, geschmiedetem oder gewalztem, in Stangen und Blechen	1 594	2 326	14 088	14 564
„ Kupferdraht, auch Telegraphenkabeln	709	643	5 883	6 834
„ groben Kupferschmiede und Gelbgiesserwaaren	5 474	6 075	12 693	13 399
„ andere Kupferschmiede und Gelbgiesserwaaren	4 673	4 955	25 844	28 112

V. Zinn.

William Elmore in London hat die Herstelllung von Zinnplatten, verzinnten Gegenständen und der dabei benutzten Werkzeuge patentirt (D. P. 19335 v. 20. Januar 1882). (Fig. 23 u. 24.) An dem Niederschlagsgefäss *A* sind Winkeleisen *B* angebracht; die Endseiten sind mit Zahnstangen *C* verbunden, in welche Zahnräder *D* eingreifen. Diese sind am Rahmen *E* gelagert, der durch Führungsrollen an dem Winkeleisen *B* geführt ist. Das

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Gewicht des Rahmens wird durch Gegengewicht *F* balancirt. Der Rahmen *E* kann mit der ganzen Ladung von Platten *J* durch die Zahnstangen *C* und Räder *D* gehoben oder gesenkt werden; er besteht aus Messing- oder Kupferstangen. An jeder Endseite sind zwei abwärts gerichtete Kupferstangen *G*, 15 cm von einander befestigt, welche rechtwinklig umgebogen und bis zur entgegengesetzten Seite in der Längsrichtung des Apparates

Fig. 23.

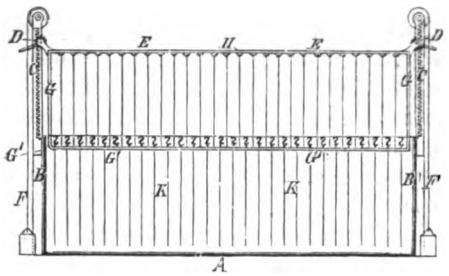
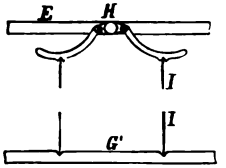


Fig. 24.



fortgeführt sind, wo sie wieder aufwärts gebogen und mit dem Rahmen *E* verbunden sind. An dem Rahmen *E* sind Querstangen befestigt und an diesen scharnierartige Halter *H* gelagert, welche die Platten zwischen *E* und den Querstangen *G'* stützen.

Zum Poliren und Putzen der Oberfläche dient eine Vorrichtung, deren Gestell die Lagerplatte und die durch einen Riemen bewegten Stahlbürsten trägt, zwischen welchen die Platten durchgeführt werden. Dann gelangen die letzteren auf eine Lagerplatte, welche eine polirte Stahloberfläche hat und auf der sie durch einen hin und her bewegten Polirstahl unter Zufluss von Lauge polirt werden.

John D. Grüneberg in Marburg stellt nach den D. P. 15108 und 18899 vom 24. Januar 1882 wasserdichte Metalltapeten aus Zinn her. Reines Zinn oder eine Plattirung, eine Metalllegierung wird so fein wie möglich gewalzt. Dieses Metallpapier wird mit Firniss überzogen, gauffrirt oder mit Wasserfarben, welche zum Bedrucken gewöhnlicher Papiertapeten benutzt werden, bearbeitet. — Diese Tapeten werden von bauverständiger Seite gerühmt.

Um schwammförmiges Zinn zu bereiten, welches zur Fabrikation von sog. Silberpapier und in der Kattundruckerei benutzt wird, ist es nach Puscher (Dingl. pol. J. 246 S. 437) erforderlich, die Zinnsalzlösung erst mit Salzsäure anzusäuern, dann so zu verdünnen, dass auf 10 Liter nur 25 g Salz kommen. Das schwammförmige Zinn, welches man durch Eintauchen von Zinkstangen erhält, wird auf Sieben gesammelt, gewaschen, muss ein Haarsieb passiren und wird dann mit Stärkekleister zusammengerieben. Die auf den Sieben zurückbleibenden Teilchen werden in Salzsäure gelöst und die Lösung wird der nächsten Zinnsalzlösung zugesetzt. Zinnschwamm wird auch zum Verzinnen benutzt, indem derselbe mit einer gesättigten Salmiaklösung angerührt und auf die betr. Gegenstände gestrichen wird. Dann wird eine Minute lang erhitzt, gewaschen und mit Kreide polirt.

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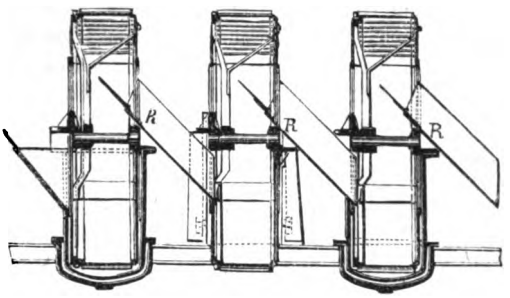
Eine Vorrichtung zum Entzinnen von Metallen besteht nach dem D. P. 21628 vom 8. Juni 1882 von F. A. Reinecken und L. Poensgen in Düsseldorf aus einer Anzahl (etwa sieben) Trommeln, von denen die zweite und die beiden letzten als Waschtrommeln, die übrigen als Lösetrommeln dienen. Letztere tauchen beständig mit ihrem unteren Teile in einen Behälter, welcher die Lösungsflüssigkeit enthält.. Der Behälter wird entweder direct befeuert oder ist mit einem Doppelmantel versehen, in welchem Dampf behufs Erwärmung der Lösungsflüssigkeit circulirt. Die zu entzinnenden Gegenstände gelangen zuerst durch einen Trichter in die erste Trommel. In dieser werden mittelst erhitzter Natronlauge etwaige Unreinheiten, welche denselben anhaften, wie Lack, Fett, Oel, Farbe abgebeizt. Aus dieser Trommel gelangen die Gegenstände durch Vermittelung der Rinne *R* nach der zweiten Trommel, in welcher der von den Gegenständen etwa noch mitgeführte Sand und die anhaftende Lauge entfernt wird. In der dritten, vierten und fünften Trommel, welche wie die erste construirt sind, wird das auf den Gegenständen befindliche Zinn aufgelöst. Die Lösungsflüssigkeit besteht aus einer Lösung von Kali- oder Natronhydrat in Wasser, welches bis zum Ueberschuss mit Bleioxyd gesättigt ist. Die sechste und siebente Trommel dienen wie die zweite Trommel lediglich als Waschtrommeln.

Fig. 25.



Adolf Gutensohn in London entfernt das Zinn von Weissblech nach dem Engl. P. 3772 vom 30. August 1881 folgendermaassen. Die Weissblechschnitzel kommen zusammen mit scharfem Sand in einen eisernen revolvirenden Cylinder, der erhitzt werden kann. Der Sand entfernt das schmelzende Zinn leicht von dem Eisen. Die grösseren Zinnkügelchen können durch Sieben von dem Sand getrennt werden. Wenn Wasser und eine Substanz, welche sich mit dem Zinn chemisch verbindet, wie Kalk oder Thonerdephosphat zugesetzt wird, so ist die Erhitzung nicht notwendig. Das Zinn wird dann aus der Lösung gefällt.

Statistik.

Im Deutschen Reich betrug, in metr. Centnern ausgedrückt, die

Waarengattung.	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an rohem Zinn, Bruchzinn . .	56 358	62 725	6 672	6 135

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VI. Blei.

George T. Lewis in Philadelphia. Verfahren zur Verarbeitung von Bleirauch auf Bleiglätte und Mennige. D. P. 21296 vom 18. Juli 1882. Es soll nicht nur der Bleirauch aus den Bleischmelzöfen, sondern auch der beim Sublimiren und Oxydiren von Bleiglanz, sowie der aus gemischten Blei- und Zinkerzen erhaltene benutzt werden.

Der aus Bleiglanzen entwickelte Bleirauch enthält Bleisulfat, Bleisulfit, Bleioxyd, Arsenik und Antimon, auch Bleisulfid und bei Gegenwart von Zinkerzen auch Zinkoxyd. Der Bleirauch wird mit Soda oder Aetznatron gemischt und dann geröstet. Durch Auswaschen des Röstproductes werden Natriumsulfat und -sulfit sowie die arsen- und antimonhaltigen Natriumverbindungen abgeschieden. Die Bleiverbindungen sind in Bleioxyd übergeführt. Der Bleirauch kann auch mit Soda- oder Aetznatronlösung gekocht werden, wobei sich Bleicarbonat und -hydroxyd bilden, während Arsen und Antimon sich auflösren. Der ausgewaschene Niederschlag wird geröstet.

Bei Gegenwart von Zinkverbindungen werden diese zunächst durch Kochen mit Schwefelsäure entfernt. Ist Bleisulfid vorhanden, so geht ein Kochen mit Chlorkalklösung voraus.

Aus den Lösungen wird nach Abscheidung des Arsens und Antimons Natriumsulfat gewonnen.

Die anzuwendenden Verhältnisse werden durch die Natur und Zusammensetzung des Bleirauchs bedingt. Zu je $151\frac{1}{2}$ Teilen Bleisulfat bezw. $143\frac{1}{2}$ Tln. Bleisulfit gehören 53 Tle. kohlensaures Natron oder 40 Tle. Natronhydrat. Am besten ist es, einen Ueberschuss von 5 Proc., d. h. 55 bis 56 Tle. kohlensauren Natrons zu haben.

Praktische Versuche haben ergeben, dass zur Auflösung von je 99 Tln. arseniger Säure 53 Tle. kohlensauren Natrons vollkommen genügen. Für je $119\frac{1}{2}$ Tle. Bleisulfür genügen Chlorkalk oder Chlornatron, wenn sie $106\frac{1}{2}$ Tln. Chlornatron und 53 Tln. kohlensauren Natrons entsprechen.

Wenn also der Bleirauch aus 0·57 Proc. Kohlensäure, 61·30 Proc. Bleisulfat, 28·97 Proc. Bleioxyd, 3·79 Proc. Bleiglanz und 5·37 Proc. arseniger Säure besteht, so werden für 100 Tle. Rauch $3\frac{1}{3}$ Tle. Chlornatron und 29 Tle. kohlensaures Natron angewendet werden müssen.

Statistik.

Im Deutschen Reich betrug, in metrischen Centnern ausgedrückt, die

Waarengattung	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an rohem Blei, Bruchblei . .	19 726	26 121	418 751	522 639
an Blei- und Kupfererzen, auch silberhaltigen	264 461	296 774	24 634	20 273

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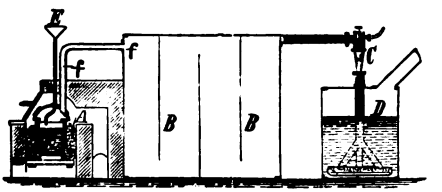
VII. Edle Metalle.

Ein Verfahren zur Gewinnung von Gold und Silber aus Antimon, Arsen, Schwefel und Tellur enthaltenden Erzen ist von Charles de Vauréal in Paris (D. P. 20593 vom 2. März 1882) angegeben.*) Die pulverisirten Erze werden mit mehrfach Schwefelnatrium gemischt und dann bei Luftabschluss behufs Verwandlung in Natriumsulfosalze geglüht. Die Masse wird mit warmem Wasser, welches die Hälfte der für die Calcinirung aufgewendeten Schwefelleber enthält, ausgewaschen. Das Filtrat wird eingedampft. Das so erhaltene Natriumsulfantimoniat wird mit Eisenfeilspänen geglüht. Das hierdurch erhaltene Antimon ist von guter Qualität. Wenn das Erz Gold enthält, so muss die filtrirte Flüssigkeit vor ihrem Eindampfen ein kleines Filter passiren.

Der Rückstand von der Auswaschung enthält kein Antimon mehr oder nur sehr geringe Mengen. Derselbe wird bei niedriger Temperatur geröstet, um die Schwefelverbindungen in Sulfate zu verwandeln. Das geröstete Erz wird einer ersten Auslaugung mit Wasser unterworfen, welches 0·2 bis 0·3 Proc. Kochsalz von dem Gewichte des Erzes gelöst enthält. Das entstandene Chlorsilber ist unlöslich, während das Kupfer-, Eisen- und Zinksulfat sich lösen. Nach dieser ersten erfolgt die zweite Auslaugung mit Chlormagnesiumlösung, in welcher das Chlorsilber sich löst.

Nach dem Verfahren von Heinrich Rössler in Frankfurt a. M. zur Reduction und Scheidung von Gold, Silber, Kupfer und Blei aus geschmolzenen Schwefelmetallen unter Zuführung von Gebläseluft (D. P. 18967 vom 5. Februar 1882) werden die Schwefelmetalle in dem Tiegel *A*, (Fig. 26) geschmolzen, etwa vorhandene Schlacken werden abgezogen; dann wird der Ejector *C* angelassen, wodurch Luft bei *E* in den Deckel eingesaugt und auf die Oberfläche der geschmolzenen Masse geblasen wird. Es bildet sich schweflige Säure, die von *f* aus durch den Kühlapparat *B* gesaugt und in das Condensationsgefäss *D* geblasen wird, zusammen mit etwa mitgerissenen Metallteilchen.

Fig. 26.



Durch Wechselwirkung von gebildeten Oxyden mit den Schwefelmetallen bilden sich an der Oberfläche äusserst feine Metallkörnchen, die in der geschmolzenen Masse niedersinken. Es scheidet sich zunächst Gold aus, dann Silber und Blei und zuletzt Kupfer.

Alexis Drouin in Paris wendet zur Extraction von Blei, Silber, Kupfer, Nickel und Kobalt auf nassem Wege folgendes Verfahren an. (Engl. P. 3646 vom 22. August 1881.) Die gepulverten und bei nie-

*) Techn.-chem. Jahrb. 1882, S. 91.

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Emil Möhlau in Düsseldorf und Aug. Schnakenberg in Barmen-Rittershausen geben ein Verfahren zur Verbleiung von Metallen an (D. P. 19722 vom 6. December 1881). Das zu verbleiende Metall wird in einer verdünnten Schwefelsäurelösung rein abgebeizt, dann mit Wasser rein abgespült, mit Lötwasser (Auflösung von Zink in Salzsäure) bestrichen und verzinnt. Sodann wird auf die rein abgeputzte Fläche Hartblei mittelst der Wasserstoffgasflamme in beliebiger Dicke aufgetragen und dann die Oberfläche bearbeitet.

Ehregott Schröder in Leipzig. Neuerungen in der Herstellung galvanisch vernickelten Eisen-, Zink- oder Weissbleches (D. P. 19720 vom 16. November 1881). Die gereinigten Zink-, Eisen- und Weissbleche werden auf galvanischem Wege $^1/_{10}$ mm stark, ohne vorherige Kupferplattirung, direct vernickelt und dann unter einem Walzwerke auf die erforderliche Grösse und Stärke in mässig erwärmtem oder kaltem Zustand gebracht, indem sie mehrere Male durch die Walzen geführt werden, bis sie die gewünschte Stärke und eine glatte Oberfläche besitzen. Bei dem Weissblech wird je nach Bedürfnis die Walzung vor und auch nach der Vernickelung vorgenommen.

J. E. Chaster in Manchester nimmt bei der Vernickelung (Engl. P. 6 vom 2. Januar 1882) als metallabsetzende Flüssigkeit nicht das Doppelsulfat, sondern das Doppelcitrat von Nickel und Ammonium, wodurch weniger elektromotorische Kraft erfordert werden soll.

James Whiting in Manchester hat folgendes Verfahren zum Phosphorisiren von Bronze oder Messing behufs Erzeugung von Draht, Blechen und dergl., sowie zum Herstellen von Drahtgeweben angegeben. (D. P. 22701 vom 31. Mai 1882.) Starker Bronze-, Messing- oder anderer Draht wird längere Zeit in eine Lösung von 0·125 — 5 Proc. Phosphor in Aether, Schwefelkohlenstoff oder Olivenöl, 5—10 Proc. Schwefelsäure und 85—95 Proc. Wasser gelegt, wobei das Metall Phosphor aufnehmen soll. Den Draht zieht man alsdann um eine Nummer feiner und bringt ihn in eine geschlossene Retorte oder dergleichen, deren Boden mit einer dünnen Schicht Phosphor versehen ist, so dass die entwickelten Phosphordämpfe über den Draht streichen. Hierauf wird derselbe in Holzkohle gepackt, diese entzündet und der Draht eine Zeit lang in der Hitze gehalten, so dass er erweicht und wiederum umeine Nummer feiner gezogen werden kann. Die letzteren Behandlungsweisen werden abwechselnd so lange wiederholt, bis der Draht die gewünschte Feinheit besitzt. Der auf diese Weise phosphorisirte Draht soll eine grössere Widerstandsfähigkeit besitzen, eine höhere Politur annehmen und dem Corrodiren nicht unterworfen sein.

W. H. Walenn in London. Elektroabscheidung von Kupfer etc. (Engl. P. 1639 vom 4. April 1882.) Die Lösung wird bis nahe zum Siedepunkt erhitzt. Das Bad ist von einem Deckel bedeckt, welcher eine lange gewundene Condensationsröhre enthält. Oben hat diese einen Behälter, welcher Stoffe zur Absorption der entweichenden Gase enthält.

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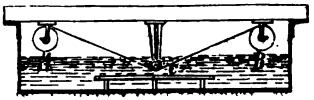
Ingénieur Lang in Schlettstadt hat sein Verfahren, um Metallgewebe auf galvanischem Wege mit Nickel, Kupfer, Silber oder einem anderen Metall zu überziehen, weiter ausgearbeitet. (D. P. 19542 vom 10. März 1882.)*) Ist das zu vernickelnde Metallgewebe sehr lang, so wird dasselbe, um zu grosse Bassins zu vermeiden, auf eine Walze *A* gewickelt, während das andere Ende ebenso mit der Walze *B* verbunden wird. Man lässt nun beide Walzen in gleicher Richtung erst rechtsdrehend, dann linksdrehend rotiren und erreicht dadurch einen gleichmässigen Niederschlag innerhalb der elektrolytischen Flüssigkeit auf das Gewebe. Verlängert man das Gewebe in den Enden durch ebenso breite, nichtleitende Bänder und verfährt wie beschrieben, so wickelt sich das Gewebe bald auf *A* bald auf *B* auf und wird schützend vom nichtleitenden Bande bedeckt. Durch die Walze *C* wird, wie früher angegeben, dem Gewebe der ganzen Breite nach die Elektricität zugeführt.

Fig. 27.



Um die Dichtigkeit von Metallen und Legirungen zu erhöhen, werden dieselben nach L. Clémandot in Paris (Engl. P. 696 vom 13. Februar 1882) soweit erhitzt, dass die nötige Ductilität eintritt, dann einem starken Druck ausgesetzt und unter andauerndem Druck abkühlen gelassen. Die Dichtigkeit der Metalle nimmt beträchtlich zu, und Stahl kann während des Druckes dauernd magnetisirt werden. Als Kraft soll vorzugsweise hydraulischer Druck angewendet werden.

Ein Verfahren von Hermann Reusch in Dillingen an der Saar (D. P. 20974 vom 16. September 1881) zur Plattirung von Eisen und Stahl mit in der Rotglühhitze streckbaren Metallen und Metalllegirungen besteht in dem Auswalzen eines Packets, welches zusammengesetzt ist aus dem zu plattirenden Eisen- oder Stahlstück, dem Plattirungsmetall und einer Zwischenlage von Zinnfolie oder gepulvertem Zinn oder einer leichtflüssigen Zinnlegirung unter Benutzung eines flüchtigen pulverisirten oder aufgelösten Chlormetalles.

Um Metalle und andere Substanzen zu emailliren und zu verkitten wird nach Chr. J. Erichsen in Kopenhagen (D. P. 16364 vom 5. Juni 1881) die Metallfläche mit Wasserglas überzogen, darauf mit einer aus Wasserglas und pulverisirtem Asbest bestehenden Mischung, welcher auch Kalk oder Gyps zugesetzt sein können, behandelt und stark erhitzt.

Diese Mischung kann auch als Kitt zur festen Verbindung metallener und anderer Körper angewendet werden.

Nach dem D. P. 19255 vom 22. Juli 1881 des G. Gehring in Landshut trägt man bei der Emaillirung von Metallen und Legirungen in der Gussform auf die Gussform und den Kern eine Isolirschicht auf, welche aus einem Brei von fein gepulvertem Speckstein, Holzkohle und Petroleum

*) Vgl. Techn. chem. Jahrb. 1883, S. 49.

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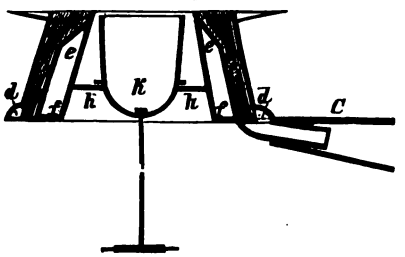
besteht. Diese Schicht wird mit Emaillirwasser, bestehend aus 3 T. schwefelsaurer Magnesia und 2 Tln. gebrannter Magnesia in 100 Tln. Wasser bestrichen und hierauf wird die Emaillirmasse aufgesiebt.

Nach dem Zusatz-Patent 20961 vom 25. April 1882 werden Gussform und Kern mit einer Isolirschicht aus calcinirter Infusorienerde oder aus Glimmerpulver, oder aus geglühten Magnesiumsilicaten (Speckstein u. dergl.), welche Stoffe mit verdünntem Seifenwasser zu einer streichbaren Masse angerieben werden, bestrichen. Nach dem Trocknen trägt man auf die Isolirschicht gewöhnliches Email auf, welches mit Wasser unter geringem Zusatz von Kleister oder Gummi angerieben worden ist, trocknet und vollzieht dann den Guss.

R. Schade in Sorau. Verbesserung an Schmelz- und Emaillir-Oefen mit Petroleumheizung für Goldarbeiter. (D. P. 21968 vom 6. August 1882.) Es ist ein Schutzschirm *ef* angebracht, welcher dazu dient, den Dochtbehälter *c* vor zu starker Erwärmung durch den Fangtiegel *k* zu schützen. Der ringförmige Canal *d* soll eine völlig gleichmässige Durchtränkung des Dochtes herbeiführen, und die Lappen *h*, welche um den Fangtiegel *k* und den Schutzschirm *ef* herum angebracht sind, sollen zur Regulirung der inneren Luftzufuhr dienen, während der Tiegel vermittelst der Spindeln in Rotation versetzt wird. Der doppelarmige Träger *c* trägt den Petroleumbehälter, welcher nach Beendigung des Schmelzens von dem oberen auf den unteren Arm gestellt wird, wodurch ein Zurücklaufen des Petroleums aus *c* nach dem Behälter bewirkt wird.

Fig. 28.



Ein Verfahren zur Reinigung von Eisen und Stahl von Ch. Edwards in Paris (Engl. P. 3333 vom 13. Juli 1883) besteht darin, dass das Metall in einer gusseisernen Retorte bei 600 bis 700° mit feuchtem Wasserstoffgas behandelt wird. Die Auslassröhre für das Gas taucht in eine Flüssigkeit, deren Höhe den Druck innerhalb der Retorte regulirt. Der vorhandene Wasserdampf soll die Metalloide als Wasserstoffverbindungen aus dem Eisen entfernen, während der überschüssige Wasserstoff alles vorhandene Eisenoxyd reducirt.

IX. Chlor, Salzsäure, Brom.

Um die auf regenerirten Braunstein einwirkende Salzsäure von Schwefelsäure zu befreien und dadurch einen Niederschlag von Gyps und die Anwendung von überschüssiger später zu neutralisirender Säure zu vermeiden, wird dieselbe nach Charles Wigg in Liverpool (Engl. P. 1220 vom 14. März

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1882) mit Barium- oder Strontiumchlorid behandelt. Der ausgewaschene Niederschlag von Bariumsulfat wird mit Chlorcalcium geglüht. Die geschmolzene Masse lässt man aus dem Ofen ausfliessen und in dünnen Kuchen erstarren. Diese werden dann mit möglichst reinem Wasser bei 35° ausgelaugt. Dies muss möglichst rasch geschehen, damit nicht zwischen dem Calciumsulfat und dem gelösten Bariumchlorid die umgekehrte Reaction eintrete. Zur erstmaligen Darstellung des Chlorbariums soll das natürliche Sulfat in der beschriebenen Weise mit Chlorcalcium behandelt werden. — Wenn bei der Chlordarstellung die Salzsäure auch schweflige Säure enthält, so wird zur Oxydation derselben etwas Mangansuperoxyd zugesetzt.

J. W. Leather in St. Helens hat ein Engl. P. 2493 vom 29. Mai 1882 auf die bekannte Reinigung roher Salzsäure vermittelst Schwefelbariums, um Schwefelsäure und Arsen zu entfernen, erhalten.

Ein von Carl Opl in Hruschau, österr. Schlesien, patentirtes Verfahren zur Fabrikation von Chlorkalk (D. P. 23587 vom 14. October 1882) beruht darauf, dass mittelst positiven oder negativen Druckes das Chlorgas durch das poröse Kalkhydrat getrieben wird.

Das Kalkhydrat ist für Luft nicht unbedeutend durchlässig; die Durchlässigkeit ergiebt sich aus der von den Erfindern durch Versuche gefundenen Formel $L = 1818 \frac{FD}{H}$, wo L Liter Luft in der Stunde, F Fläche, H Höhe der Kalkschicht und D den Druck der Luft in Meter Wasser bedeutet. Eine Kalkschicht von 1 qm von 1 m Höhe unter einem Druck von 10 m Wasser würde z. B. 78 180 l Chlorgas oder 57 kg Chlor absorbiren. Dieses Kalkmehl im Gewicht von 500 kg braucht 250 kg Chlorgas und wäre daher in 250 : 57 = 43 Stunden in Chlorkalk verwandelt. In Wirklichkeit kann man die Absorption wegen der hierbei entstehenden Erwärmung nicht so weit treiben, da sonst der Chlorkalk wieder zersetzt werden würde.

Es muss bei dem neuen Verfahren hauptsächlich darauf gesehen werden, dass die entwickelte Wärme unschädlich gemacht wird. Zwei Wege sind hierfür offen, der eine durch Anwendung von Wasserkühlung, der andere durch Verdünnen des Chlorgases mit trockener Luft. Wenn dieses in entsprechender Weise geschieht, so gelingt es nach diesem Verfahren, den stärksten Chlorkalk zu erzeugen.

A ist eine Chlorkammer. Dieselbe unterscheidet sich von den gewöhnlichen Kammern durch einen doppelten Boden *r*, im übrigen kann sie ganz gleich construirt sein. Der zweite Boden *r* ist ein doppelter Lattenboden, von in Leinöl getränkten Holzplatten hergestellt; zwischen beide Lattenböden kann eine Leinwand gelegt werden, um kein Durchreissen von Kalkmehl zu ermöglichen.

Zum Absaugen der Luft bezw. zum Durchdrücken des Chlorgases durch das Kalkhydrat dient eine Wasserluftpumpe *K*, deren abfliessendes Wasser gleich als Kühlwasser verwendet werden kann. Bei verdünnterem Chlorgas kann eine Luftpumpe oder ein Dampfstralgebläse angewendet werden.

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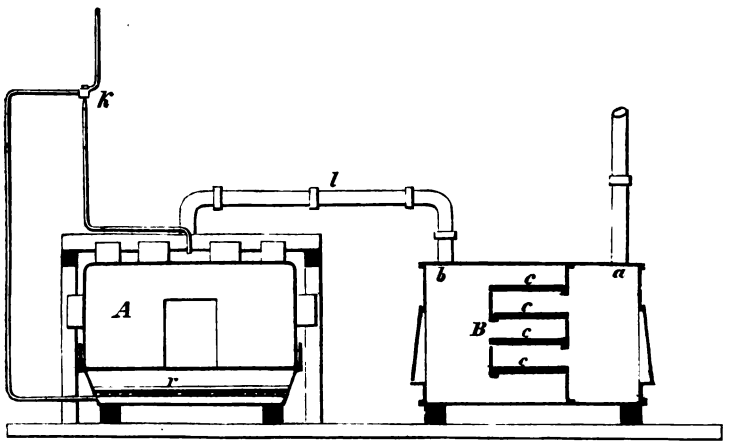
Zur Kühlung wird Wasser auf die Kammer gelassen, welches sich über die Decke verbreitet, an den Wänden herabfliesst und in der Rinne, oberhalb des gusseisernen Bodenteiles, weggeführt wird.

Wenn nötig, wird Luft zum Verdünnen und Kühlen durch ein Ventil in die Kammer geleitet. Der Chlorkalk ist gesättigt, wenn unterhalb des Rostes Chlorgas auftritt. Er zeigt 115 bis 120°.

Um den stärksten, 120 bis 125gradigen Chlorkalk zu erzeugen, muss das Chlorgas erst einer Reinigung unterzogen werden. Es wurde die Beobachtung gemacht, dass, wenn man eine höhere Schicht Kalkmehl mit Chlor sättigt, die oberste Lage immer die schwächsten Grade zeigte, da von ihr alle Unreinigkeiten des Chlorgases, als Wasserdampf, Salzsäure und Kohlensäure, aufgenommen wurden.

Fig. 29.



Die Reinigung des Chlorgases im grossen wird in dem Apparat *B* vorgenommen. Dieser Apparat beruht auch auf dem Princip, dass Chlorgas unter Druck gezwungen wird, eine Schicht Kalkmehl, in diesem Falle von ungelöschtem gemahlenem Kalk, zu durchstreichen. Um hierbei nicht viel Druck verwenden zu müssen, wird die Kalkschicht möglichst niedrig genommen; es muss daher die Fläche vergrössert werden. Der Reinigungsapparat *B* stellt eine Kammer von Gusseisen vor, in welcher auf Trägern etagenartig die Rahmen *C* liegen. Die gusseisernen Rahmen *C* sind mit Holzstäben ausgelegt und bilden den Boden, auf den das zur Reinigung des Chlors nothwendige Kalkmehl aufzustreuen ist. Um das Chlorgas zu reinigen, genügen 2 bis 4 pCt. Kalkmehl von dem Gewichte des zu erzeugenden Chlorkalkes.

Das Chlorgas wird in die Kammer bei *a* eingeleitet, passirt die Kalkschicht und tritt bei *b* aus und wird durch die Leitung *l* in die Chlorkalk-

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kammer *A* geleitet. Mit gereinigtem Chlorgas soll es nun möglich sein, den höchstgradigen Chlorkalk in den beschriebenen Kammern zu erzeugen; ausserdem soll das Verfahren bedeutend billiger sein, da die Kalkschicht in der Kammer das Zehn- und Mehrfache als bei dem bisher üblichen Verfahren betragen kann, keinen Verlust an Chlor und daher auch keine Belästigung der Umgebung ergeben.

H. Precht in Neu-Stassfurt. Verfahren zur Absorption von Salzsäure aus Feuergasen mittelst gebrauchter Knochenkohlen. (D. P. 19769 vom 24. Februar 1882.) Die Absorption gasförmiger Salzsäure, welche durch Feuerungsgase stark verdünnt ist, lässt sich mit Wasser selbst bei Benutzung eines mit Coks gefüllten Condensationsturmes schwer erreichen, und man erhält bei Anwendung grosser Quantitäten Wasser eine sehr verdünnte Salzsäure. In den meisten Sodafabriken werden zwar zur Fabrikation von Natriumsulfat Muffelöfen gebraucht, Kaliumsulfat wird dagegen wegen der schwierigen Zersetzbarkeit des Chlorkaliums in Flammöfen dargestellt, und es entweicht daher eine mit Verbrennungsgasen verunreinigte Salzsäure. Auch bei der Darstellung von Magnesia aus Chlormagnesium durch Zersetzung mit heissen Feuerungsgasen, ferner beim Glühen von Chloraluminium u. s. w. resultirt stets eine verunreinigte Salzsäure, deren Condensation mit Schwierigkeiten verbunden ist.

Precht lässt nun die Salzsäuregase durch Knochenkohle absorbiren, welche beim Filtriren von Zuckersaft Calciumcarbonat aufgenommen hat. Bei der Wiederbelebung der Knochenkohle muss das aufgenommene Calciumcarbonat ja doch durch Behandlung mit Salzsäure entfernt werden.

Die Absorptionsapparate werden am besten aus Holz hergestellt, in welchen die Knochenkohle auf Horden ausgebreitet ist.

Während der Absorption der Salzsäure muss die Knochenkohle mit Wasser befeuchtet werden, wodurch das gebildete Chlorcalcium sofort gelöst und mit dem abfliessenden Wasser entfernt wird. Nach dem Lösen des Calciumcarbonats wird die Knochenkokle in bekannter Weise weiter gereinigt.

Die Vereinigten chemischen Fabriken, Actien-Gesellschaft in Leopoldshall, haben den früher beschriebenen*) Apparat zur continuirlichen Darstellung von Brom jetzt folgendermaassen eingerichtet. (D. P. 19780 vom 2. Februar 1882.) Es soll vornehmlich folgenden Uebelständen abgeholfen werden: 1. Die Verteilung der zufliessenden Bromlauge in dem Hauptturme war nicht genügend gleichmässig; 2. die Vorrichtung zum Austreiben des freien Chlors und Broms aus der am Boden sich ansammelnden Lauge mittelst Wasserdampf genügte nicht und ist durch eine andere ersetzt worden; 3. die schliessliche Absorption der nicht condensirten Bromdämpfe durch Eisen war unvollkommen; 4. der Chlorstrom war nicht gleichmässig genug.

*) Techn.-chem. Jahrb. 1882, S. 100.

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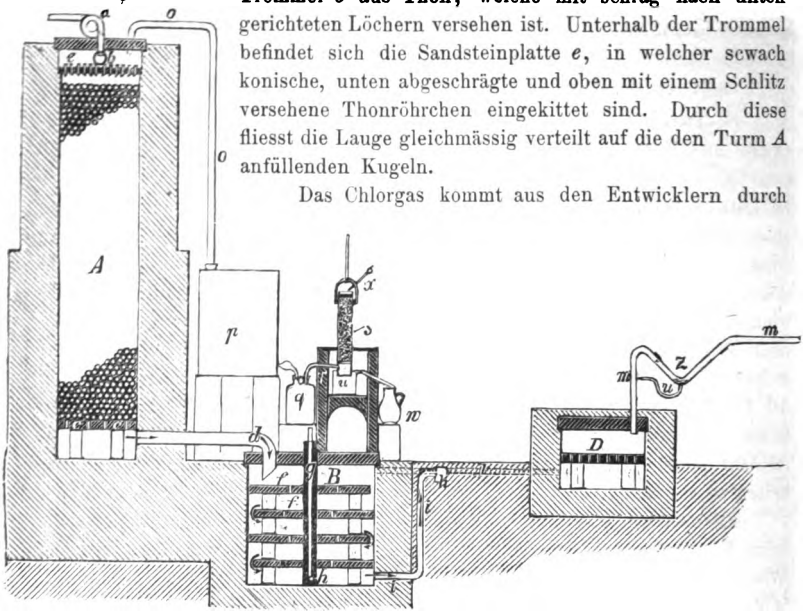
In dem neuen Apparate (Fig. 30) fliesst die heisse Bromlauge durch das Rohr *a* zunächst in eine durch die ganze Weite des Turmes *A* reichende Trommel *b* aus Thon, welche mit schräg nach unten gerichteten Löchern versehen ist. Unterhalb der Trommel befindet sich die Sandsteinplatte *e*, in welcher sowach konische, unten abgeschrägte und oben mit einem Schlitz versehene Thonröhrchen eingekittet sind. Durch diese fliesst die Lauge gleichmässig verteilt auf die den Turm *A* anfüllenden Kugeln.

Fig. 30.



Das Chlorgas kommt aus den Entwicklern durch Rohr *m*. Zur Regulirung ist an *m* das mit einem Tubus versehene Glasrohr *z* angebracht. Diese Tubulatur ist durch einen Gummischlauch mit einem Stutzen am anderen Arme von *m* verbunden. In dem Knierohr *z* sammelt sich condensirtes Wasser an, das durch die Tubulatur in den Waschapparat *D* fliesst. Bei stärkerem Chlorstrom wird mehr Wasser ausgetrieben, und die Grösse des Durchgangs für das Gas im Glasrohr *z* lässt die Stärke des Chlorstroms beurteilen.

Soll der Chlorentwickler abgesperrt werden, so wird der Schlauch *u* abgezogen, und man lässt nun Wasser durch die Tubulatur in das Glasknie, bis völliger Abschluss erreicht ist. Das Chlorgas strömt durch den Waschapparat *D*, Rohr *l* und Apparat *B* durch das Rohr *d* in den Turm *A* der Lauge entgegen.

Die Lauge sammelt sich unter dem Siebboden *c*, fliesst durch *d* in den Apparat *B*, wo durch Wasserdampf das gelöste Chlor und Brom ausgetrieben wird. Die Lauge fliesst hier im Zickzack über die mit Schlitzen versehenen Sandsteinplatten *f* und schliesslich durch das Rohr *i* in den Abflusscanal *k*. Der Dampf tritt durch den Sandsteinstutzen *g* und die horizontal liegende durchbohrte Sandsteinröhre *h* in den Apparat und durchdringt, Löcher in den Platten *f* passirend, die Lauge. Diese, beständig siedend, füllt den Be-

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hälter *B* bis zum Rohr *d*, dessen abgeschrägtes Ende noch Raum zum Einströmen des Chlors lässt.

Die im Turm *A* aufsteigenden Bromdämpfe werden durch Rohr *o* der im Kühlgefässe *p* befindlichen Thonschlange zugeführt. Das flüssige Brom gelangt in die Flasche *q*. Die nicht condensirten Dämpfe kommen durch das Rohr *r* in das Thonrohr *s*, welches in das Ueberlaufgefäss *u* taucht. In *s* liegen auf durchlöchertem Boden Eisenspäne, welche vom Rohre *x* aus durch zuströmendes Wasser feucht erhalten werden. Hier wird alles Chlor und Brom absorbirt, und die Lauge fliesst in das Gefäss *w*. Wasserdämpfe und Luft entweichen aus einer oberen Oeffnung des Rohres *s*.

X. Schwefel, Schweflige Säure, Schwefelsäure.

1. Schwefel.

Zur Wiedergewinnung des Schwefels aus Sodarückständen macht Carl Opl in Hruschau, Oester. Schlesien (D. P. 23142 vom 8. October 1882) von diesen und Wasser einen Brei und leitet Schwefelwasserstoff ein. Man wendet hierzu eiserne Apparate mit Rührwerk an, in welche vermittelst Luftpumpen Schwefelwasserstoff eingedrückt wird. Die von dem Calciumcarbonat getrennte Lauge besteht aus Calciumsulfhydrat und kann auf Schwefel, unterschwefligsaure Salze oder Schwefelwasserstoff verarbeitet werden. Man kann das Schwefelwasserstoffgas auch in statu nascendi einwirken lassen, indem man auf in Wasser suspendirte Sodarückstände Kohlensäure oder eine andere Säure einwirken lässt, jedoch nur in dem Maasse, als der entwickelte Schwefelwasserstoff von noch vorhandenen Rückständen bezw. Schwefelcalcium aufgenommen werden kann. (s. Seite 87.)

Um Schwefel aus Schwefelwasserstoff zu gewinnen, benutzt C. F. Claus in London (Engl. P. 3608 vom 29. Juli 1882) das Eisenhydroxyd, welches zur Absorption von Schwefelwasserstoff aus beliebiger Quelle dient. Wenn dieses kein Gas mehr zu zersetzen vermag, so wird der Schwefel abgetrieben, und das entstandene Eisenoxyd kann nicht mehr Schwefelwasserstoff absorbiren und muss durch frisches Eisenhydroxyd ersetzt werden. Nach dieser Erfindung kann es aber weiter gebraucht werden, wenn der Apparat, in welchem dasselbe auf Schwefelsäurewasserstoff einwirkt, auf einer Temperatur von 100 bis 105° gehalten wird. Wenn der Schwefelwasserstoff wenig verdünnt ist, so wird diese Temperatur zweckmässig dadurch inne gehalten, dass dem Gase, bevor es über das zu Anfang auf 110° erhitzte Eisenoxyd streicht, so viel Luft zugemischt wird, das nur der Wasserstoff verbrennt. Die Zersetzung geht dann contunuirlich fort. Wenn der Schwefelwasserstoff stark verdünnt ist, so ist äussere Wärme erforderlich, die dem Eisenoxyd oder dem Gase oder zweckmässig der erforderlichen Luftmenge erteilt wird. In beiden Fällen wird der freigewordene Schwefel von

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dem Gasstrom mitgeführt und in an die Zersetzungskammer sich anschliessenden Räumen gesammelt.

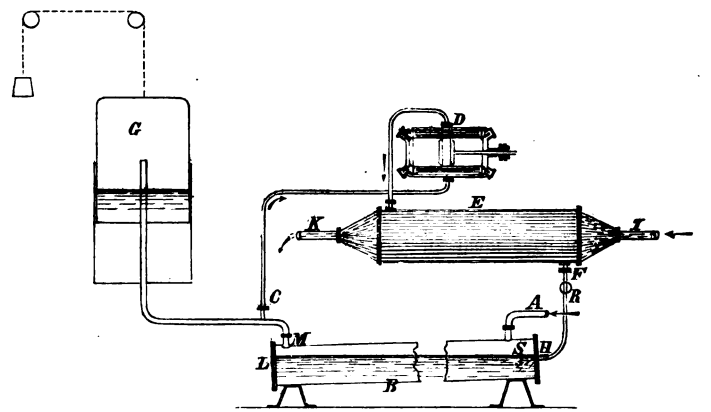
G. Robertson Hislop in Paisley gewinnt den Schwefel aus dem Gaskalk (Engl. P. 2730 vom 10. Juni 1882), indem dieser mit Teer oder Coks gemischt und erhitzt wird. Die calcinirte Masse wird in Wasser gelöscht. Wenn durch Reduction von Calciumsulfat viel Sulfid zugegen ist, so kommt die Masse in den ersten Gasreiniger, wo durch die im Gas enthaltene Kohlensäure das Sulfid zersetzt wird. Der Schwefelwasserstoff wird dann durch Eisenoxyd beseitigt. Auch Gyps soll in dieser Weise behandelt werden, wobei dann das Sulfid durch die Kohlensäure von Ofengasen zersetzt werden soll.

II. Schweflige Säure.

Die Compagnie Industrielle des Procédés Raoul Pictet in Paris hat Neuerungen in der Herstellung von Schwefligsäureanhydrid patentirt. (D. P. 22365 vom 10. August 1882.) Es hat sich ergeben, dass die ganze Gruppe der Schwefligsäurehydrate bei — 10° C. krystallisirt. Die gasförmige Säure scheidet bei solcher Temperaturerniedrigung den gesammten in ihr enthaltenen Wasserdampf aus.

Die gasförmige, aus den Retorten kommende, irgendwie hergestellte schweflige Säure (von welcher sich die durch Zersetzung der im Handel vorkommenden Schwefelsäure durch Schwefel erhaltene am besten eignet) gelangt

Fig. 31.



durch Röhre *A*, die einen der Production entsprechenden Durchmesser, also ca. 12 cm Durchmesser für eine tägliche Production von 1500 kg hat, in ein 18 bis 20 m langes Kühlrohr *B* von 20 cm Durchmesser, welche Dimensionen je nach dem Zweck und dem gegebenen Fall variiren. Rohr *B* ist ein wenig gegen das Ende *L* geneigt und durch Autoclavenverschlüsse geschlossen. Aus dem Rohr *M* entweicht das gereinigte Gas und gelangt nach einem mit

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Oel gefüllten Gasometer *G*. Von *M* zweigt sich ein Rohrstutzen *C* ab, welcher das Rohr einer kleinen Saug- und Druckpumpe *D* trägt.

Diese Pumpe comprimirt das gasförmige Schwefligsäureanhydrid und drückt dasselbe nach dem Condensator *E*, der aus einem beständig von Wasser umflossenen Röhrensystem besteht.

Das flüssige Schwefligsäureanhydrid geht dann durch Rohr *F*, welches mit einem Regulirhahn *R* versehen ist, und gelangt in Form eines beständigen Strales bei *S* in das grosse Kühlrohr *B*, welches dadurch auf — 10° C. abgekühlt wird.

Da nun die gasförmige schweflige Säure gezwungen ist, das Kühlrohr auf ihrem Wege nach dem Gasometer zu durchströmen, so wird dieselbe gleichmässig der Kälte ausgesetzt und werden alle darin enthaltenen Hydrate in Form von Krystallen ausgeschieden werden.

Die Geschwindigkeit der Pumpe *D* wird derart regulirt, dass die flüssige Säure ungefähr ein Drittel des Kühlrohres *B* ausfüllt.

Wird die Operation langsam fortgesetzt, so sammelt man zuletzt in flüssiger Form die gesamte dargestellte schweflige Säure in deren Kühlrohr *B* an. Sobald Reif die ganze Röhre bedeckt und man durch die Länge der Operation weiss, dass das Volumen der schwefligen Säure genügend gross ist, setzt man die Compressionspumpe *D* ausser Betrieb und beginnt von neuem mit der Herstellung gasförmiger schwefliger Säure. Dieselbe wird im Rohr *B* vollständig vom Wasser befreit und gelangt als chemisch reines und trockenes Schwefligsäureanhydrid durch Rohr *M* nach dem Gasometer *G*. Von Zeit zu Zeit setzt man auch die Pumpe *D* wieder in Bewegung, um die Flüssigkeit im Rohr *B* auf demselben Niveau zu erhalten.

Nach Verlauf von vier bis fünf Tagen unterbricht man die Operation, öffnet die Auclavenverschlüsse *L* und *H* und entleert das Kühlrohr *B*; die Schwefligsäurehydrate schmelzen bei + 15° C., so dass sie aus dem Rohre fliessen.

Edw. Bramwell in St. Helens bezweckt beim Rösten der Pyrite (Engl. P. 2748 vom 12. Juni 1882) diese möglichst vollständig abzurösten, möglichst concentrirte schweflige Säure zu erhalten, das Chargiren und Entleeren der Oefen zu erleichtern und das Entweichen von schwefliger Säure aus den Oefen zu verhindern. Um dies zu erreichen, kommt die Röstluft mit verschiedenen Mengen Kiesen in Berührung, zuerst mit schwefelreichen, zuletzt mit nahezu erschöpften (so ist es in der Patentschrift angegeben, vermutlich ist das Umgekehrte gemeint). Ein System von Oefen ist deshalb ringförmig oder in parallelen Reihen angeordnet, durch welche die Verbrennungsluft strömt. Dabei wird die Verbindung der Oefen durch Röhren hergestellt oder unterbrochen, so dass jeder Ofen in dem System einmal der erste für den Eintritt der frischen Luft wird. An den Oefen sind oberhalb der Roste noch Oeffnungen vorgesehen, um, wenn nötig, noch mehr Luft einzulassen.

Nach Henry Wurtz in New-York (Engl. P. 4218 vom 30. September

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1881) werden die gepulverten Pyrite mit Pulver von metallischem Eisen (etwa 5—10 pCt. vom Gewicht der Pyrite) vermischt, die Mischung wird mit einer Salzlösung befeuchtet und zu Blöcken geformt. Durch das Pulvern der Pyrite wird eine gute Reinigung erzielt. Es soll gröberes mit feinerem Pulver vermischt werden. Durch die Salzlösung wird das Rosten des Eisens rasch bewirkt. Das Eisenhydroxyd kittet die Teilchen zusammen. Das Rosten wird durch abwechselndes Befeuchten und Erwärmen befördert. Die Cohäsion der Massen wird durch Zusatz eines faserigen oder blättrigen Materials, wie Asbest oder Glimmer, erhöht. Das Eisenpulver oder der Eisenschwamm wird durch Reduction der Röstrückstände gewonnen. Als Salzlösung, welche das Rosten beschleunigt, eignet sich am besten die Lösung von Eisenvitriol (etwa 5 pCt. vom Gewicht der Pyrite); doch sind auch andere Sulfate brauchbar.

III. Schwefelsäure.

Manufacture de Javel in Paris. Fabrikation von Schwefelsäure. (Engl. P. 1752 vom 13. April 1882.) Der Erfinder findet einen grossen Vorteil darin, die Stickstoff-Sauerstoff-Verbindungen nicht in die erste Bleikammer allein, sondern zu geringen Teilen auch in die folgenden Kammern und in den Gay-Lussac-Turm einzuführen. Werden die nitrosen Verbindungen nur in die erste Kammer gebracht, so kann die Temperatur sich hier so erhöhen, dass eine Reduction zu Stickoxydul, selbst zu Stickstoff eintritt, während in den folgenden Kammern die Temperatur zu niedrig für die Schwefelsäurebildung sein können. In Folge der Anwendung von Schwefelsäure, welche etwas Nitrose enthält, für den Gay-Lussac sollen aus diesem weder nitrose Dämpfe noch schweflige Säure entweichen.

William Windus in Bristol (Engl. P. 367 vom 24. Januar 1882) will die Kammersäure nicht im Gloverturm denitriren, sondern durch heftiges Bewegen der Schwefelsäure die Stickstoffoxyde aus dieser abscheiden, bevor sie die Kammern verlässt. die Gasentwickelung soll durch Luftverdünnung befördert werden. Die Bewegung soll durch ein Rührwerk hervorgebracht werden, oder einfacher dadurch, dass dünne Stralen Schwefelsäure von der Decke der Kammer in die am Boden befindliche Säure fallen.

Ch. Girard und J. H. Pabst in Paris verwenden nach dem Engl. P. 3584 vom 17. August 1881 und D. P. 18486 Bleikammerkrystalle, um übelriechende und schädliche Gase zu zersetzen.

Gustav Delplace in Namur hat Neuerungen an seinem Schwefelsäure-Concentrationsapparat angegeben (D. P. 23159 vom 31. December 1882 ab). Der bisherige Delplace'sche Apparat zur Concentration der Schwefelräure besteht in einem niedrigen, mit einer Haube versehenen, Platinakessel, bei welchem die der zu concentrirenden Säure entsteigenden Dämpfe in der Haube condensirt und dann wieder in die Bleikammern zurückgeleitet wurden. Diese Construction hatte den Nachteil, dass mit dem Destillat auch sämtliches abgedampfte Wasser nach den Bleikammern oder den Bleipfannen zurückgeführt wurde, um dort von neuem teils abgedampft

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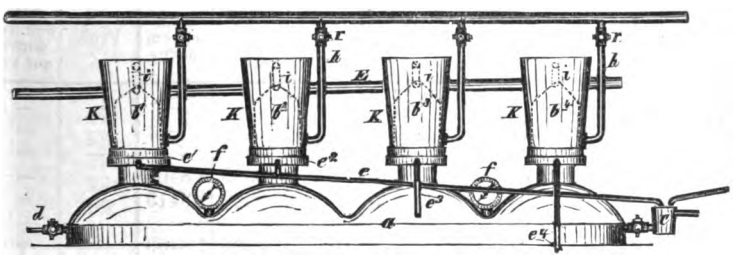
teils wieder nach dem Platinakessel zurückgeführt zu werden. Der neue Apparat beseitigt diesen Misstand durch Teilung des Destillats derart, dass an der dem Einfluss zunächst liegenden Stelle, woselbst nur Wasser abdestillirt wird, dieses gesondert aufgefangen und abgeleitet wird, an einer anderen Stelle das übergehende, sehr schwache Schwefelsäurehydrat aufgefangen und nach den Bleikammern oder den Bleipfannen zurückläuft, während an anderen Stellen, woselbst bereits hochgradiges Schwefelsäurehydrat übergeht, dieses unmittelbar nach dem Eingange des Apparates zurückgeleitet und, mit der vorconcentrirten Kammersäure vermischt, durch den Apparat geführt wird. Auf diese Weise lässt sich bei continuirlichem Betriebe mit Hilfe eines einzigen Kessels eine höchst concentrirte Schwefelsäure von bis 98 Proc. Monohydratgehalt erzeugen, was bei den bisherigen Apparaten nicht möglich war.

Ueber dem langen, flachen, an den Enden abgerundeten Kessel *A* erhebt sich eine Decke, welche mehrfach gewölbt ist und auf jeder dieser

Fig. 32.



Wölbungen als Sturzglocke mit äusserer Wasserkühlung die Condensationshelme b^1 b^2 b^3 und b^4 trägt. Das aus den Helmen herablaufende condensirte Destillat dichtet diese Helme in die um die Ausgangsöffnungen angebrachten Säureverschlüsse ab und wird durch seitlich angelötete Röhrchen abgeleitet.

In den Condensationshelm b^4, welcher dem Einlauf *C* am nächsten liegt, geht nur Wasser über, welches durch das Rohr e^4 abfliesst. Das Destillat des Condensationshelmes b^3 enthält ausser vielen Wassers auch bereits übergegangene Schwefelsäure und wird durch das Rohr e^3 nach den Bleikammern zurückgeleitet. Bei den Helmen b^2 und b^1 ist die Concentration der den Apparat passirenden Säure bereits so weit vorgeschritten, dass dort sehr hochgradige Säure abdestillirt wird, die sich in den Helmen sammelt und von dort durch die Rohre e^1 e^2 und *e* nach dem Einlauftrichter *C* zurückfliesst und mit der ankommenden Kammersäure direct wieder durch den Apparat geleitet wird. Die concentrirte Säure verlässt bei *d* den Apparat.

Zwei Pyrometer *f* dienen zur Controle der Temperatur der Säure im Kessel.

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Der Apparat steht unmittelbar über den Feuern und es empfiehlt sich, den Boden desselben aus gewelltem Platinblech zu machen, wodurch dieser bei bedeutender Dünne seiner Wandung verstärkt und auch besser in den Stand gesetzt wird, sich nach Maassgabe der wechselnden Temperaturverhältnisse auszudehnen und zusammenzuziehen.

B ist das Wasserzulaufrohr für das Kühlwasser. Letzteres tritt aus dem Rohr *B* durch die mittelst der Hähne *r* verschliessbaren Rohre *h* zwischen die Helme b^1 . . . und Kühlbehälter *k* und verlässt diesen Raum wieder durch die Röhre *i*, um durch das Rohr *E* abzulaufen.

G. Lunge und P. Naef haben das Volumgewicht der höchst concentrirten Schwefelsäuren bestimmt. Die folgende Tabelle zeigt die erhaltenen Resultate zusammen mit denen einiger früherer Autoren.

Volumgewichte der höchst concentrirten Schwefelsäuren bei 15° C.

Lunge und Naef			F. Kohlrausch		W. Kohlrausch bei 15°			Scheertel	
Proc H_2SO_4	uncorrigirt	corrigirt	Proc.	Vol.-Gew. reducirt auf 15°	Proc.	reducirt nach seinem Coeffiz.	nach unsrem Coeffiz.	Proc.	Vol.-Gew. reducirt auf 15°
—	—	—	94·00	1·8355	—	—	—	—	—
94·84	1·8412	1 8387	—	—	—	—	—	—	—
—	—	—	95·00	1·8382	—	—	—	—	—
95·97	1·8432	1·8406	96·00	1·8402	—	1·8389	1·8402	—	—
—	—	—	97·00	1·8413	96·00	1·8402	1·8415	—	—
97·70	1·8439	1·8413	—	—	96·87	—	—	—	—
—	—	—	98·00	1·8416	—	1·8396	1·8409	—	—
98.39 *)	1·8432	1·8406	—	—	98·00	—	—	98·5	1·8426
98·66**)	1·8435	1·8409	—	—	—	1·8389	1·8402	98·66	1·8431
—	—	—	99·00	1·8406	98·67	1·8376	1·8389	—	—
—	—	—	—	—	99·08	—	—	99·23	1·8414
99·47	1·8421	1·8395	—	—	—	1·8365	1·8378	99·35	1·8406
—	—	—	—	—	99·43	1·8398	1·8411	—	—
100·01	1·8410	1·8384	100·00	1·8372	99·79	1·8439	1·8452	100·00	1·8396
100·35	1·8437	1·8411	—	—	99·98	1·8484	1·8497	100·28	1·8404
100·49	1·8440	1·8414	—	—	100·20	—	—	100·57	1·8433

Auch die Schwefelsäuren zwischen 90 und 95 Proc. als die für die Industrie wichtigsten wurde auf ihr Vol.-Gew. untersucht; die stärkste gewöhnliche Handelssäure, die von 95 Proc., wird als die von 66° Baumé bezeichnet. Im allgemeinen ist das Vol. Gew. der Handelssäure ein wenig höher, namentlich infolge von Arsengehalt, als das der reinen Säure. In folgender Tabelle sind die mit * bezeichneten Zahlen direct beobachtet die übrigen durch graphische Interpolation abgeleitet.

*) Säure von Griesheim, durch directes Eindampfen im grossen dargestellt.

**) Dargestellt durch Mischen von gewöhnlicher starker mit anhydridhaltiger Säure.

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Tabelle der Volumgewichte der höchst concentrirten Schwefelsäuren für die Temperatur von 15° (auf Wasser von 4° und luftleeren Raum reducirt).

Proc. H_2SO_4	Reine Säure.	Handelssäure von Uetikon.	
	Spec. Gew.	Spec. Gew.	Baumé
90	1·8185	1·8202	65·1°
* 90·20	1·8195	—	—
* 90·29	—	1·8219	—
91	1·8241	1·8254	65·4°
* 91·48	1·8271	—	—
92	1·8294	1·8306	65·6°
* 92·83	1·8334	— 6	—
93	1·8339	1·8344	65 8°
94	1·8372	1·837	65·9°
* 94·09	—	1·8375	—
* 94·84	1·8387	—	—
95	1·8390	1·8397	66·0°
* 95·26	—	1·8404	66·0°
* 95·97	1·8406		
96	1·8406		
97	1·8410		
* 97·70	1·8413		
97·75	—	1·8468*)	66·2°
98	1·8412		
* 98·39	1·8406**)		
* 98·66	1·8409***)		
99	1.8403		
* 99·47	1·8395		
* 100·00	1·8385		

Walter Weldon in Burstow sucht die Rückstände aus der Schwefelsäurefabrikation nach dem Engl. P. 3560 vom 16. August 1881 zu verwerten, indem die Eisenchloridlösung, welche bei der Verarbeitung der Pyritrückstände auf Kupfer erhalten wird, in Combination mit den „gelben Laugen", welche bei Verarbeitung der Sodarückstände sich ergeben, verwertet wird.

Die Rückstände von der Kupferextraction werden mit Chlorcalciumlösung, als welche die Rückstände des Weldon-Chlorprocesses dienen können, behandelt. Aus dem Natriumsulfat in jenen wird Gips gefällt. Die davon abgeschiedene Lösung von Eisenchlorid und Chlornatrium kann zur Fällung von Schwefel aus den „gelben Laugen" dienen. Oder es wird der Lösung vorher Kalk oder Eisenoxyd zugesetzt.

$$Ca(SH)^2 + FeCl^2 = CaCl^2 + FeS + H^2S$$
$$CaS^2 + FeCl^2 = CaCl^2 + FeS + S.$$

*) Säure von Griesheim, durch directes Eindampfen im grossen dargestellt.
**) Dargestellt durch Mischen von gewöhnlicher starker mit anhydridhaltiger Säure.
***) Dargestellt durch directes Eindampfen von gewöhnlicher starker Säure.

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Der Niederschlag, welcher Schwefel, Schwefeleisen und event. andere Metallsulfide enthält, wird nach vorheriger Oxydation an der Luft verbrannt. Die Menge des Zusatzes von Kalk oder Eisenoxyd richtet sich nach der Beschaffenheit der gelben Laugen. Es darf sich kein Schwefelwasserstoff entwickeln.

IV. Schwefelsäureanhydrid.

Bis jetzt sind im allgemeinen zwei Methoden der Schwefelsäureanhydridfabrikation in Thätigkeit, einmal die Darstellung aus zweifach schwefelsauren, wasserfreien Salzen*) und dann die Darstellung nach Winkler, der mit der Zersetzung des ersten Schwefelsäurehydrats in $SO^2 + O + H^2O$ beginnt, dann die Gase entwässert, und dieselben endlich durch die bekannten Contactsubstanzen zu SO_2 vereinigt.

W. Rath in Plettenberg benutzt als Sauerstoffquelle die Luft; er stellt also durch die directe Vereinigung von SO^2 und dem Sauerstoff der Luft SO^3 her. Die aus einem Kiesofen austretenden Gase werden vermittelst einer Pumpe oder einer anderen Vorrichtung zunächst durch einen Condensator gesaugt, in welchem Wasserdampf und Flugstaub grösstenteils zurückgehalten werden. Alsdann treten dieselben unten in einen mit Coks gefüllten Bleiturm, durch welchen von oben her beständig Schwefelsäure von ca 66° B. einfliesst. Hier werden die Gase vollständig getrocknet. Aus demselben gelangt das Gemisch von schwefliger Säure, Stickstoff und Sauerstoff in den Vereinigungsofen, in welchem sich vertical stehende, eiserne Retorten, mit feuerfestem Futter versehen und mit Contactsubstanz gefüllt, befinden. Diese Retorten werden zwischen Hell- und Dunkelrotglut erhalten und in ihnen werden die Gase $SO^2 + O$ mit Hilfe der Contactsubstanz zu Schwefelsäureanhydrid vereinigt, welches entweder condensirt und dann im verlangten Verhältnis mit Schwefelsäurehydrat vermischt wird oder unter Abkühlung in solches eingeleitet wird. Enthalten die Röstgase Kohlenoxyd und Kohlenwasserstoffe, (was der Fall ist, wenn bei der Röstung von Mineralien und Hüttenproducten Brennmaterial angewendet worden ist) so wird zwischen dem Gaserzeugungsofen und den Kühlapparat noch ein besonderer Verbrennungsofen eingeschaltet, in dessen rotglühend erhaltener mit feuerfestem Futter versehener Retorte diese verbrannt werden. (D. P. 22118 vom 4. August 1882.)

V. Anhang: Rauchgase.

Die nach dem Freytag'schen Verfahren**) zur Absorption der in den Röstgasen befindlichen Schwefelsäure benutzte Schwefelsäure absorbirt nach Versuchen von Hasenclever auch die schweflige Säure, besonders in der Kälte, und kann demnach zur Gewinnung von schwefliger Säure aus Feuerungs- und Röstgasen benutzt werden. (D. P. 17371 vom 20. April 1881.)

*) Techn.-chem. Jahrb. 1881, S. 61; 1882, S. 107; 1883, S. 57.

**) Vgl. Techn.-chem. Jahrb. 1882, S. 103.

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Nach Th. Oppler in Doos bei Magdeburg (D. P. 19591 vom 3. Februar 1882) sollen gas- und dampfförmige Säuren durch Briquettes absorbirt werden, welche aus Absorptionsmitteln (Alkalien, alk. Erden, Metalloxyden, Salzen) und porösen Stoffen, wie Holzkohle, Steinkohle, Coks, Braunkohle, Torf, Sägespänen, mit Hilfe von Leim, Gummi, Stärke, Wasserglas oder anderen Klebmitteln geformt werden.

Farnham Maxwell Lyte in London teilt mit, dass zur Absorption der schwefligen Säure aus Rauchgasen nach dem Engl. P. 5416 vom 10. December 1881, ausser den im Engl. P. 3443/1881 angegebenen Hydraten von Magnesium oder Aluminium,*) auch Zinkhydroxyd oder Eisenhydroxyd benutzt werden können. Die Oxyde werden auf durchlöcherte Böden in Kammern gebracht. Die eintretenden Rauchgase werden durch Wasser bis auf 100° abgekühlt. Aus den entstandenen Sulfiten wird durch Erhitzen die schweflige Säure ausgetrieben. Zur Reduction der entstandenen Sulfate wird den Oxyden Kohle beigemengt. Weniger vorteilhaft, als die erwähnten Hydroxyde, sind die des Kupfers, Nickels etc.

VI. Statistik.

Im Deutschen Reich betrug in metr. Centnern ausgedrückt, die

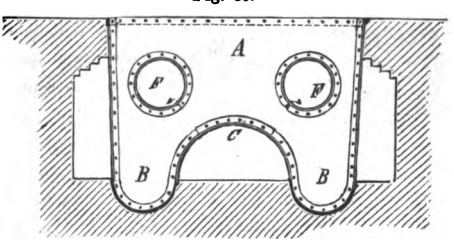
Waarengattung	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an Schwefel	97 368	92 429	4 067	3 170

XI. Kochsalz und Sodafabrikation.

I. Kochsalz.

F. Fiedler in Leopoldshall-Stassfurt giebt zur Vergrösserung der Heizfläche und möglichst vollkommener Ausnutzung der Wärme der Siedepfanne *A* einen Sattelboden *BCB* (bekannt), sowie die beiden Flammenrohre *FF*. (Fig. 33.) (D. P. 18960 vom 15. November 1881.)

Fig. 33.



Anton Vogl in Hallein

*) Vgl. Precht in Techn.-chem. Jahrb. 1883, S. 42.

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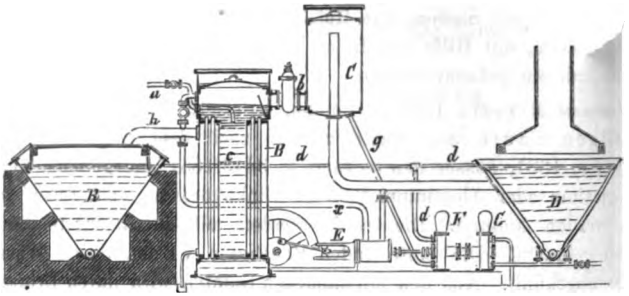
und Ch. Freiherr v. Bechtolsheim in München haben folgende Neuerungen an Salzsiedepfannen angebracht. (D. P. 20391 vom 28. März

Fig. 34.



Die aus der Feuerpfanne *R*, aus der das Salz durch Schnecke und Paternosterwerk ausgezogen wird, aufsteigenden Dämpfe werden durch eine, einen Wasserverschluss bildende Kappe aufgefangen und dienen zum Heizen des Vacuumkessels *B*, der durch Leitung *a* stets mit frischer Soole gespeist wird, und dessen Deckel, durch eine Flüssigkeitsschicht abgedichtet, lose aufliegt. Der Kessel *B* steht mit dem durch Schieber *b* abzusperrenden Dampfdom *C* in Verbindung. Hierdurch wird die Reinigung der um das weite Rohr *c* gruppirten Heizrohre während des Betriebes ohne Störung des Vacuums ermöglicht. Die gare und halbgare Soole wird fortwährend durch die Rohrleitung *g*, Pumpe *F* und Leitung *d* zum weiteren Versud in die Salzpfannen *R* und *D* befördert. In letzterer findet lediglich Verdunstung statt. Dieselbe ist doppelwandig und wird durch den aus dem Dom *C* zugeführten Dampf geheizt. Der Betrieb der Pumpen *F* und *G*, von denen die letztere das Condensationswasser aus der Doppelwand von *D* entfernt, geschieht durch eine Dampfmaschine *E*, deren Betriebdampf von Atmosphärendruck der aus der Pfanne *R* kommenden Rohrleitung *h* durch Zweigrohr *x* entnommen ist.

J. Zabel in Schönebeck a. Elbe. Verdampfungsgefäss. (D. P. 21883 vom 13. September 1882.) Die rotirenden Schaufeln und Schnecken *s* des cylinderförmigen Verdampfgefässes *A* nach dem System Piccard überziehen sich beim Passiren des Dampfraumes *B* jedesmal mit einer dünnen Salzschicht, die nach mehrtägigem Betriebe zu einem harten Salzstein anwächst, der sich leicht stückweise ablöst und Brüche verursachen kann. Um diesem Uebelstande abzuhelfen, sind die Schaufeln und Schnecken unter den Spiegel der Soole verlegt; dadurch, dass man das Verdampfgefäss entweder in seiner ganzen Länge mit einem Dom als Dampfraum versieht (Fig. 36) oder ihm einen länglich runden Querschnitt, am besten den eines Eies mit der Spitze nach oben, giebt.

Fig. 35.

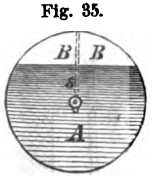
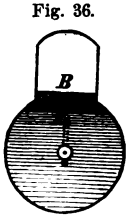


Fig. 36.



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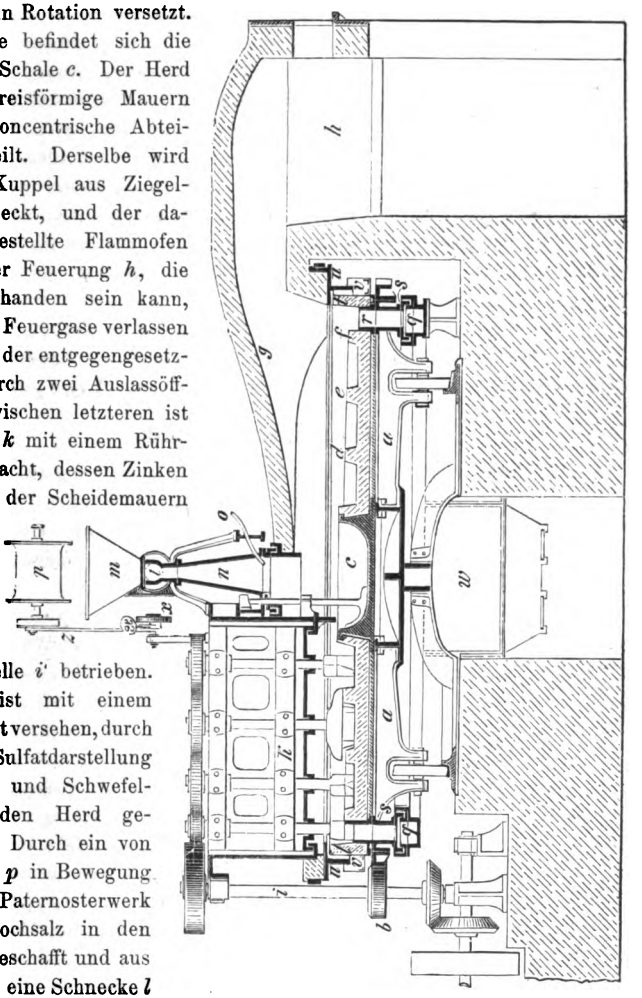
de Neuerur
. März

II. Sulfat.

Einen neuen rotirenden Sulfatofen hat James Mactear in Glasgow (D. P. 18627 v. 31. December 1880) angegeben, Fig. 37. Der Herd *a* ruht auf Rädern und wird durch das Getriebe *b* in Rotation versetzt. In der Mitte befindet sich die gusseiserne Schale *c*. Der Herd ist durch kreisförmige Mauern *d*, *e*, *f* in concentrische Abteilungen geteilt. Derselbe wird von einer Kuppel aus Ziegelwerk *g* bedeckt, und der dadurch hergestellte Flammofen wird von der Feuerung *h*, die paarweis vorhanden sein kann, beheizt. Die Feuergase verlassen den Herd an der entgegengesetzten Seite durch zwei Auslassöffnungen. Zwischen letzteren ist ein Rahmen *k* mit einem Rührwerk angebracht, dessen Zinken die Flächen der Scheidemauern *d*, *e*, *f* abschaben. Die Wellen des Rahmens werden von der Hauptwelle *i* betrieben. Der Ofen ist mit einem Speiseapparat versehen, durch den für die Sulfatdarstellung Chlornatrium und Schwefelsäure auf den Herd gebracht wird. Durch ein von der Trommel *p* in Bewegung gesetztes Paternosterwerk wird das Kochsalz in den Trichter *m* geschafft und aus diesem durch eine Schnecke *l* in einen horizontalen Canal und weiter in die verticale Röhre *n* geführt. Durch die Trommel *p* wird, wie Fig. 38 zeigt, auch die Speisung aus dem Trichter in regulirbarer Weise bewirkt, indem die Schnecke *l* durch das Schaltrad *x* bewegt wird, welches seinerseits durch die in dem geschlitzten

Fig. 37.



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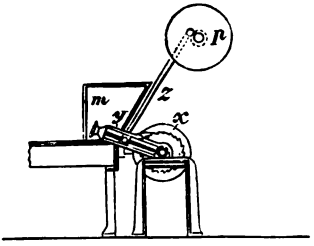
Sperrhakenhebel *y* verschiebbare Kurbelstange *z* in Bewegung gesetzt wird. Die Schwefelsäure wird durch die Röhre *o* zugeführt. Die Materialien gelangen in die Schale *c* und aus dieser nach und nach in die concentrischen Abteilungen. Die letzte Abteilung *r* bildet die Entleerungsöffnung, welche in den nicht drehbaren ringförmigen Canal *q* mündet.

Fig. 38.



Die Entleerungsöffnung ist mit einem ⊓förmigen ringförmigen Stück *s* verbunden, welches, in mit Sand gefüllte Rinnen tauchend, luftdichten Abschluss des Canals *q* bewirkt. Der Canal *q* besitzt eine oder mehrere Entleerungsbüchsen *w* mit Bodenklappen, aus welchen das Sulfat periodisch in den darunterstehenden Rollwagen fällt. Der äussere Rand *t* des Drehherdes befindet sich unter der ringförmigen Platte *u*, von der aus ein Flantsch in die Sandrinne *v* taucht.

Der Herd kann auch ohne Scheidewände *d*, *e*, *f* eben oder hohl hergestellt sein. Die Dichtungsrinnen können anstatt mit Sand mit einer von dem sauren Gase nicht angreifbaren Flüssigkeit, wie Teer, gefüllt sein.

III. Leblanc-Soda.

W. Malcolm in Lasswade hat einen Ofen und Apparat zum Eindampfen und Calciniren von Sodalaugen patentirt. (Engl. P. 4794 vom 2. November 1881.) Das Patent bezieht sich auf mechanische Vorrichtungen, um die auf der verdampfenden Lauge sich bildenden Krusten zu zerkleinern, sowie auf Kratz- und Rührvorrichtungen.

In Bezug auf die Reinigung der Sodalösungen seien folgende zwei Patente erwähnt. Carey, Gaskell und Hurter in Widnes. (Engl. P. 5310 vom 5. December 1881.) Um das Natriumferrocyanid in der Sodalauge und zumal der roten Lauge zu zerstören, wird die Flüssigkeit einer hohen Temperatur ausgesetzt. Dies geschieht, indem dieselbe durch Kessel oder Schlangenröhren getrieben wird, welche bis auf die Zersetzungstemperatur 195° erhitzt werden. Um das Sieden zu verhindern, wird die Flüssigkeit unter einem Druck von 250—350 Pfund auf den Quadratzoll gehalten. Man muss Vorsorge treffen, dass keine festen Stoffe in die Schlangenröhren treten, und dass Kieselsäure und Thonerde vorher entfernt werden. Die Lösungen sollen nicht zu concentrirt sein, etwa 40° Twaddle haben, denn bei 195° ist die Löslichkeit von Soda geringer als bei 105°. Das Eisen des Ferrocyanids findet sich fein suspendirt als Sulfid und Oxyd.

H. W. Deacon und Holbrook Gaskell in Widnes. (Engl. P. 5312 vom 5. December 1881.) Nachdem die Alkalilösung durch Behandlung mit Kohlensäure von Thonerde und Kieselsäure gereinigt ist, wird dieselbe in einem Kessel unter Druck erhitzt, bis das darin enthaltene Ferrocyanid zersetzt ist. Das Eisen scheidet sich dabei in Form von Sulfid oder Oxyd in

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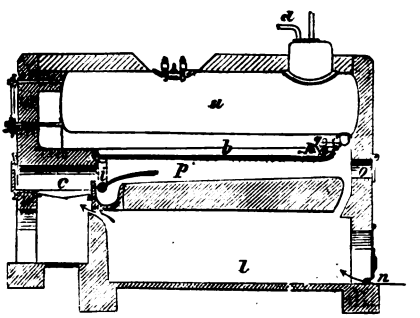
rordentlich fein verteiltem Zustand ab und setzt sich nur sehr langsam. Diese Wirkung schreiben die Erfinder der in der Lösung befindlichen schüssigen Kohlensäure zu. Um diese zu beseitigen, wird nun der ng kaustisches Alkali oder Kalkhydrat zugesetzt. Der kohlensaure Kalk muss t abfiltrirt werden. Die schwach kaustische Sodalösung kommt dann in en Kessel zur Zersetzung des Ferrocyanids. Die Abscheidung des Eisensulfids und -oxyds wird durch rasches Abkühlen der Lösung und Agitiren derselben mittelst eines Luftstroms wesentlich befördert.

Nach James Mactear in Glasgow (Engl. P. 1156 vom 10. März 1882) soll die Rohsodalauge, event. nachdem Sodakrystalle ausgeschieden sind, mit Dampf unter Druck erhitzt werden. Das frei werdende Ammoniak wird nutzbar gemacht.

C. H. Roeckner in Newcastle upon Tyne. — Apparat zur Wiedergewinnung der Soda aus Laugen. (D. P. 18493 vom 22. October 1881.) Die Lauge kommt bei *d* in den Kessel *a*, Fig. 39. Der hier entwickelte Dampf gelangt in einen Kühler, der durch ein mindestens 10 m langes Abfallrohr in ein Wasserbassin mündet. Die concentrirte Lauge lässt man durch den Hahn *g* in das durchlöcherte Rohr *h* fliessen, von wo sie in die Pfanne *b* gelangt. Von hier aus kommt die Masse durch das Rohr *i* in den Calcinirofen *p*. Die calcinirte Soda wird mittelst eines durch *o* eingeführten Schüreisens in den Kühlofen *l* geschoben, wo in der durch *n* zutretenden Luft noch eine Verbrennung stattfindet. Die hier sich entwickelnden Gase werden unter den Rost *c* geleitet.

Fig. 39.



IV. Sodarückstände.

Max Schaffner und Wilh. Helbig in Aussig combiniren die Verfahren der Leblanc- und der Ammoniak-Soda-Fabrikation unter gleichzeitiger Gewinnung von Schwefel und Ammoniak. (D. P. 19216 vom 3. Januar 1881.) Die Sodarückstände vom Leblanc-Verfahren nach dem Schaffner-Helbig'schen Regenerationsprocess*) werden mit Chlormagnesium behandelt. Hierbei bildet sich neben Schwefelwasserstoff Magnesia und Chlorcalcium. Da zur völligen Zersetzung des Schwefelcalciums ein kleiner Ueberschuss von Chlormagnesium erforderlich war, so wird jetzt, um sämtliche Magnesia zu fällen, etwas Kalk oder Dolomit zugesetzt. Diese Magnesia wird nun zur Zersetzung der Salmiaklaugen aus der Ammoniaksodafabri-

*) Techn.-chem. Jahrb. 1880, S. 143.

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kation benutzt. Das Chlormagnesium dient dann wieder zur Zersetzung neuer Mengen von Sodarückständen.

Nach dem Verfahren zur Darstellung von Schwefelnatrium aus Sodarückstand vom Verein chemischer Fabriken in Mannheim (D. P. 20947 vom 24. März 1882) wird frischer Sodaschlamm mit gemahlenem Sulfat, in äquivalentem Verhältnis des in ersterem enthaltenen Schwefelcalciums, und mit einem Zusatz von Wasser, der zur Lösung des zugesetzten Sulfats genügt, gemischt. Das Gemenge wird in geschlossenen Gefässen einem Dampfdruck bis zu 5 Atmosphären ausgesetzt. Das Schwefelcalcium des Sodaschlammes setzt sich mit dem schwefelsauren Natron in Gyps und Schwefelnatrium um. Durch Auslaugen wird das letztere von dem ersteren getrennt.

Wilhelm Helbig in Aussig hat folgendes wichtige Verfahren zur Verarbeitung der Sodarückstände angegeben. (D. P. 20948 vom 10. Mai 1882.) Wird rohe Soda oder rohe Potasche für sich, oder, was dem entspricht, Soda- oder Potasche-Rückstand mit einer dem darin enthaltenen Schwefelcalcium äquivalenten Menge von Soda oder Potasche unter einem Dampfdruck von ca. 3 Atm. mit der entsprechenden Menge Wasser gekocht, so erhält man Lösungen von Schwefelnatrium bezw. Schwefelkalium. Die Zersetzung erfolgt hierbei schneller und vollständiger, wenn auf ein Aequivalent Natron oder Kali in der Mischung mehr als ein Aequivalent Schwefelcalcium vorhanden ist.

V. Aetzalkali.

J. Berger Spence und Alex Watt in London (Engl. P. 1630 vom 4. April 1882) kommen auf das oft versuchte Verfahren zurück, Kochsalz mit Hilfe von Elektricität zu zersetzen. Die Kosten für Erzeugung der Elektricität sollen dadurch herabgemindert werden, dass das bei dem Verfahren entwickelte Wasserstoffgas als Motor zum Treiben von Gasmaschinen nutzbar gemacht wird. Die 50° warme concentrirte Kochsalzlösung befindet sich in einem Behälter, der durch Gypswände in poröse Zellen geteilt ist. Als Elektrode dient Gascoks. Während in einer Abteilung, welche eine negative Elektrode enthält, unter Entwickelung von Wasserstoff Aetznatronlösung sich bildet, wird an der positiven Elektrode Chlor frei, das zur Chlorkalkbereitung verwendet wird. Das Wasserstoffgas wird in einem Gasbehälter gesammelt und dient dann zum Treiben einer Gasmaschine, welche ihrerseits die elektrodynamische Maschine in Bewegung setzt, oder es kann verbrannt zum Eindampfen der Salzlösungen dienen.

H. Herberts in Barmen stellt Aetznatron und Aetzkali nach dem Engl. P. 3577 vom 27. Juli 1882 folgendermaassen her: In einem Behälter wird Soda oder Potasche gelöst und mit Kalk zersetzt. Dann wird die Masse durch eine Röhre, welche etwas über den Boden des Behälters hervorragt, um grössere Kalksteinstücken zurückzuhalten, in einen darunter liegenden horizontalen Kessel abgelassen. Hier geht die Causticirung vor sich, indem Dampf unter Druck eingelassen und ein Rührwerk in Bewegung gesetzt wird.

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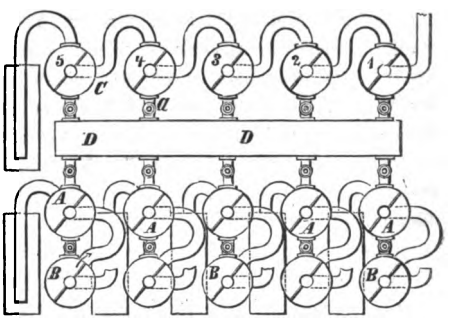
Die Flüssigkeit wird dann in einen Filtrirapparat gedrückt, wo sie ein Filter aus Stahldrahtnetz und Kalkstein zu passiren hat.

Löwig in Breslau hat folgendes Verfahren zur Darstellung von Aetznatron und Aetzkali durch Glühen von Natriumcarbonat oder Kaliumcarbonat mit Eisenoxyd angegeben (D. P. 21593 vom 31. August 1882): Ein inniges Gemenge von Soda und Eisenoxyd liefert bei starker Rotglühhitze unter Entweichung der Kohlensäure eine chemische Verbindung von Natron und Eisenoxyd, von L. Natriumferrid genannt. Dieselbe zerfällt mit Wasser in Aetznatron und sich abscheidendes Eisenoxyd. Das angewendete Eisenoxyd muss kieselsäure- und thonerdefrei sein; es soll als grobkörniges Pulver von Eisenglanz oder Roteisenstein angewendet werden. Das nach dem Auslaugen des Ferrids zurückbleibende Eisenoxyd eignet sich indess zu wiederholter Benutzung. Wird das Eisenoxyd als feines Pulver angewendet, so quillt das Ferrid mit Wasser zu einer schleimigen Masse an, die nur schwierig ausgelaugt werden kann. Man nimmt auf 1 Mol. Natriumcarbonat 2 Mol. Eisenoxyd. Die nach dem Auslaugen in dem Eisenoxyd zurückbleibende Menge Natron muss dabei in Betracht gezogen werden. Das Glühen findet zweckmässig in eisernen Retorten statt, wie sie in den Leuchtgasfabriken gebraucht werden, da dann die sich entwickelnde Kohlensäure leicht zu verschiedener Verwendung gesammelt werden kann. Durch einen Glühversuch einer Mischungsprobe muss man sich überzeugen, dass die Masse kohlensäurefrei ist. Die Auslaugung geht bei gelinder Wärme rasch vor sich.

VI. Ammoniak-Soda.

Die Société anonyme des produits chimiques du Sud-Ouest in Paris hat folgende Einrichtungen zur Fabrikation der Ammoniak-Soda getroffen. (D. P. 18709 vom 27. October 1881.) Die gesättigte Lösung von Chlornatrium kommt in eine Batterie von horizontalen Cylindern *C*, welche dünn genug sind, um eine schnelle Abkühlung herbeiführen zu können. Die Cylinder sind zu zwei Drittel mit der Lösung angefüllt und haben eine mit Rührflügeln versehene drehbare und hohle durchlöcherte Axse.

Fig. 40.



Man leitet nun der Reihe nach durch die Cylinder einen Strom von Ammoniak, bis der durchschnittliche Gehalt des Inhalts sämmtlicher Cylinder auf 10 Proc. Ammoniak gebracht ist.

Hierauf leitet man in demselben Sinne durch die Batterie der Cylinder unreine aus dem Kalkofen stammende Kohlensäure, bis die Bildung von

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Sesquicarbonat beginnt. Diese Carbonisation vollzieht sich ohne Druck; ein einfacher Wasserverschluss mit einer Wassersäule von 1 m genügt, um Verluste an Kohlensäure zu vermeiden.

Jeder Cylinder *C* trägt ein Entleerungsrohr *a*; dieses mündet in einen cylindrischen Sammelraum *D*, so dass es möglich ist, durch Zusammenführen der verschiedenen Cylinderinhalte gleichmässig starke Lösungen zu erzielen.

Die Lauge gelangt nun in eine Reihe von Batterien, in denen sie mit reiner, von der Calcination des Natriumbicarbonats herrührender Kohlensäure behandelt wird. Diese Batterien sind zusammengesetzt aus je zwei übereinander stehenden Cylindern *A* und *B*.

Man füllt zu drei Viertel den oberen Cylinder *A* und lässt den unteren Cylinder *B* vollständig leer. Der Cylinder *A* hat einen Wasserschluss von $^1/_2$ m Höhe. Der Kohlensäurestrom wird nun in den Cylinder *B* eingeleitet, der leer ist. Die Kohlensäure steigt in den Cylinder *A*, wo sie so lange absorbirt wird, bis die Flüssigkeiten nur noch Sesquicarbonat und selbst eine kleine Menge Bicarbonat enthalten.

Man erkennt das Ende der Operation daran, dass der hydraulische Verschluss nicht länger genügt, das Gas zurückzuhalten.

Nunmehr wird der Inhalt der Cylinder *A*, wesentlich Sesquicarbonat, in die Cylinder *B* abgelassen, um dort mit reiner Kohlensäure in Bicarbonat übergeführt zu werden. Die nicht absorbirte Kohlensäure sammelt sich unter mässigem Druck im oberen Cylinder *A*, von wo aus sie nach beendeter Reaction zu weiterer Verwendung gebracht wird.

Theophile Schlösing in Paris. Fabrikation von Ammoniak-Soda. (Engl. P. 2110 vom 4. Mai 1882.) Wie Schl. früher (im Engl. P. 2130/1878) angegeben hat, soll zur Bereitung des Ammoniumbicarbonats eine Ammoniakflüssigkeit angewendet werden, welche wenigstens 100 g Alkali im Liter enthält. Nach Behandlung derselben mit Kohlensäure und Abscheidung der Ammonbicarbonatkrystalle bleibt eine Mutterlauge, welche Ammoniak und Kohlensäure nahezu im Verhältnis des neutralen Carbonats enthält. Diese Flüssigkeit wird mit Ammoniak gesättigt und wieder mit Kohlensäure behandelt, macht also einen Kreislauf in der Fabrikation. Bei der Absorption der Kohlensäure tritt eine Temperaturerhöhung ein, in Folge dessen weniger Kohlensäure aufgenommen und viel Bicarbonat in Lösung gehalten wird. Die Kühlung durch kaltes Wasser, welches über den Absorptionsapparat fliesst, ist nur unvollkommen. Schl. hat nun festgestellt, dass eine Lösung des neutralen Ammoniumcarbonats, welche im Liter wenigstens 100 g Alkali enthält, bei einer Temperatur von 45 bis 50° C. 15 Proc. Ammoniumbicarbonat aufzulösen vermag, welches beim Erkalten auskrystallisirt. Bei dieser Temperatur kann dieselbe aber nicht mehr die verdünnte Kohlensäure aus Kalköfen absorbiren, sondern nur ein reiches Kohlensäuregas. Bei der Destillation verliert diese Flüssigkeit weit mehr Kohlensäure als Ammoniak, vorausgesetzt, dass die Dämpfe, welche die Destillationscolonne verlassen, nicht wärmer als 70° sind.

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Die nach der Filtration des Ammoniumbicarbonats bleibende Mutterlauge wird nun der methodischen Destillation unterworfen. Die zurückbleibende ammoniakalische Flüssigkeit wird nach dem Abkühlen mit Ammoniak gesättigt und mit verdünnter Kohlensäure (aus Kalköfen) behandelt, wobei nicht gekühlt wird; das Bicarbonat bleibt also in Lösung. In einem andern Apparat wird die Flüssigkeit mit den Destillationsproducten, Kohlensäure nebst Ammoniak und Wasserdampf, behandelt, wobei die Temperatur bis auf 50° steigt. Bei der Abkühlung, welche in einer Reihe von mit Rührwerk und Kühlmantel versehenen Cylindern stattfindet, fällt das Ammoniumbicarbonat aus. Die Mutterlauge kommt wieder in den Destillationsapparat u. s. w.

Neuerung im Ammoniaksoda-Verfahren. Von H. Schüchtermann in Dortmund und E. Kocke in Rothenfelde. (D. P. 21590 vom 14. Juli 1882.) Wenn zur Gewinnung des Natriumbicarbonats im Ammoniaksoda-Verfahren eine Zeitlang Kohlensäure in die ammoniakalische Kochsalzlösung geleitet und ein bestimmtes Quantum Bicarbonat gefällt ist, so tritt ein Moment ein, in dem kein Niederschlag mehr erfolgt, obgleich noch unzersetztes Kochsalz vorhanden ist.

Die von dem Bicarbonat getrennte Lauge wird nun vor ihrer Verarbeitung auf kohlensaures Ammoniak bezw. Ammoniak mit Aetznatron oder mit Ammoniak versetzt. Durch diesen Zusatz wird das in der Lauge neben Kochsalz und Salmiak enthaltene doppelkohlensaure Ammoniak in einfach kohlensaures Ammoniak umgewandelt. Wird jetzt von neuem Kohlensäure zugeleitet, so beginnt der Fällungsprocess aufs neue. Wird jetzt wiederum Aetznatron oder nach vorheriger Abscheidung des Bicarbonats Ammoniak zugesetzt und Kohlensäure durchgeleitet, so wird wieder ein Teil des Kochsalzes in Bicarbonat übergeführt und kann durch Wiederholung des Verfahrens die Umsetzung des Kochsalzes in Bicarbonat beliebig weit getrieben werden.

Charles Wigg in Liverpool. Fabrikation von Ammoniaksoda. (Engl. P. 3125 vom 3. Juli 1882.) Aus der starken Soole oder Kochsalzlösung soll zunächst durch arsensaures Natrium Magnesia gefällt werden, während die von den Absorptionsapparaten kommenden Gase hindurchgeleitet werden. Um eine gleichmässige Verteilung des Ammoniaks und der Kohlensäure in der Soole innerhalb der Absorptionsapparate zu bewirken, werden die Gase unter erheblichem Druck durch perforirte Schlagarme eingeführt, welche an einer rotirenden horizontalen oder verticalen Axe sitzen. Auch werden die in dem ersten Saturator eines Systems nicht absorbirten Gase in den zweiten u. s. w. geleitet. Ausserdem fliesst während der Reaction durch die hohlen Schlagarme einer andern Welle eine kühlende Flüssigkeit, kalte Kochsalzlösung.

In der Ammoniaksodafabrikation tritt bei Versetzung der nicht flüchtigen Ammoniaksalze durch Kalk Schäumen und Spritzen ein. Die Ursache davon ist Calciumcarbonat, das sich infolge der Gegenwart von geringen Mengen des nicht vollständig abdestillirbaren kohlensauren Ammoniaks

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bildet. Wenn diese nach Abdestillation der flüchtigen Ammoniakverbindungen durch Zusatz kleiner Mengen Salzsäure bis zur schwach sauren Reaction zersetzt werden, so tritt keine Schaumbildung ein. (Patent der Soc. anon. des Produits chim. du Sud-Ouest in Paris, D. P. 18773 vom 27. October 1881.)

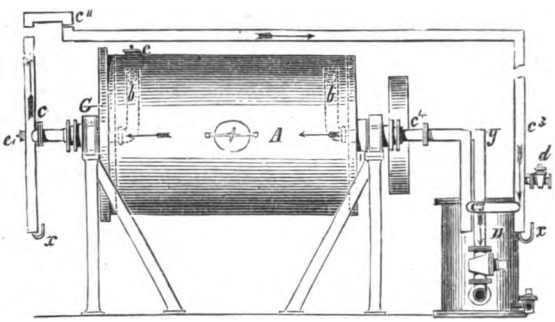
VII. Natriumbicarbonat.

Holbrook Gaskell und Ferd. Hurter in Widnes (Engl. P. 2876 vom 17. Juni 1882) behandeln nicht, wie gewöhnlich, Sodakrystalle mit Kohlensäure, sondern wenden wasserfreie Soda an, die von einem Gemisch von Dampf und Kohlensäure getroffen wird. Oder die Soda soll erst mit Wasser oder mit Dampf behandelt werden, so dass sich das Monohydrat bildet, welches alsdann der Kohlensäure ausgesetzt wird.

Nach dem D. P. 21954 vom 26. Mai 1882 von Eustace Carey in Widnes wird das Natriumbicarbonat durch Behandlung von Rohsoda mit Kohlensäure in rotirenden Cylindern dargestellt, an Stelle der bisherigen feststehenden Kammern.

Von den hohlen Zapfen des Cylinders *A* (Fig. 41) dient der eine zur Einführung, der andere zur Abführung der Kohlensäure; beide haben Verlängerungen *b*, welche in den Cylinder ragen, damit sie nicht durch die Masse verstopft werden, doch können sie nöthigenfalls durch die verschliessbaren Oeffnungen *e* und *e'* gereinigt werden. Wenn der Cylinder *A* gefüllt ist, so lässt man ihn mit einer Geschwindigkeit von 2—6 Umdrehungen pro Minute rotiren, während die Kohlensäure durch Rohr *y* in denselben eintritt. Dieselbe wird unter Temperaturerhöhung mit grosser Schnelligkeit von der Füllmasse absorbirt. Die nicht absorbirte Kohlensäure und der Wasserdampf entweichen durch Rohr *c*, welches in die Höhe geführt ist und durch c^2 mit dem wieder nach unten gerichteten Rohr c^3 und mit c^4 communicirt, welch letzteres Rohr die Kohlensäure wieder in den Cylinder *A* gelangen lässt, indem der Unterschied im specifischen Gewicht der Gase in den Röhren eine dauernde Circulation bedingt. In den Röhren schlägt sich der Wasserdampf zum grössten Teil nieder; das gebildete Wasser wird aus den Hebern *x* abgelassen. Sollte die Circulation nicht sofort beginnen, so öffnet man den Hahn *d* einige Augenblicke, worauf die Circulation beginnt und nun fortdauert. Nach be-

Fig. 41.



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endetem Process soll das Bicarbonat als trockenes Product von grosser Reinheit erhalten werden. Wird die Füllmasse während der Processes zu trocken, so lässt man die Kohlensäure in dem mit Coks und Wasserdampf gefüllten Behälter *D* sich mit Feuchtigkeit imprägniren. Man kann mehrere solcher Apparate zu einer Batterie vereinigen, welche so mit einander und mit Anfeuchtungs- und auch Trockenapparaten verbunden sind, dass die Kohlensäure in den ersten Cylinder ein und aus dem letzten ziemlich verbraucht ins Freie tritt und zwischen den einzelnen Apparaten nach Erfordernis getrocknet oder angefeuchtet werden kann.

Ueber die gegenwärtige Lage der Soda-Industrie hat Herr Walter Weldon in der Society of Chemical Industry sehr bemerkenswerte Mitteilungen gemacht. Aus der Uebersetzung seines Vortrages in der „Chemischen Industrie" 1883, S. 42 und 65 f., teilen wir auszugsweise das folgende mit.

Die letzten Jahre sind für die Leblanc-Soda-Fabrikanten vielfach verlustreich gewesen. Von 25 Sodafabriken, die vor wenigen Jahren in der Umgegend von Newcastle-on-Tyne existirten, sind jetzt nur noch 13 in Betrieb; von den übrigen 12*) sind nicht weniger als 8 thatsächlich aufgegeben worden, da es nicht möglich schien, in ihnen Leblanc-Soda anders als mit absolutem Verlust herzustellen. Die Soda fabricirenden Districte von Lancashire sind gegenüber dem Newcastle-District im Vorteil durch den geringeren Preis des Salzes, die Leichtigkeit der Versorgung des amerikanischen Marktes und die Nähe gewisser grossen Centren des Sodaverbrauchs in England; trotzdem stehen auch in Lancashire 7 oder 8 Fabriken still und nur wenige von den übrigen arbeiten mit voller Leistungsfähigkeit. In Belgien, wo früher 5 oder 6 Fabriken Leblanc-Soda darstellten, ist die Lage noch schlimmer, indem in diesem Lande die Fabrikation von Leblanc-Soda überhaupt aufgehört hat. Die einzigen europäischen Länder, in welchen ausserdem eine Soda-Industrie existirt, sind Frankreich, Deutschland und Oesterreich. In diesen Ländern ist die Sodafabrikation durch Eingangszölle geschützt, welche, wie ich glaube, die höheren Preise der Rohmaterialien gegenüber England mehr als ausgleichen:

Eingangszölle pro Tonne

	Frankreich	Deutschland	Oesterreich
	Francs	Mark	Gulden
Soda calcinirt	41	25	12
„ krystallisirt	19	15	8
Aetznatron	64	40	40
Chlorkalk	35.5	30	15

*) Die 12 Fabriken verarbeiteten ca. 67 000 Tonnen Salz jährlich, die noch in Betrieb befindlichen 13 verbrauchen ungefähr 220 000 Tonnen im Jahr.

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Ausserdem ist in allen diesen Ländern starke Nachfrage nach dem Nebenproduct des Leblanc-Verfahrens, der Salzsäure.

Gegenwärtige Soda-Production der Erde in Tonnen.

	Leblanc-Soda.	Ammoniak-Soda.	Zusammen.	Ammoniak-Soda in Proc. der Gesammt-Soda.
Grossbritannien	380 000	52 000	432 000	12·0
Frankreich	70 000	57 125	127 125	44·9
Deutschland.	56 500	44 000	100 500	43·8
Oesterreich	39 000	1 000	40 000	2·5
Belgien	—	8 000	8 000	100·0
Vereinigte Staaten	—	1 100	1 100	100·0
Zusammen . . .	545 500	163 225	708 725	23·0

Diese Tabelle zeigt, dass die jährliche Gesamtproduction an Soda jetzt nahezu 710 000 Tonnen beträgt, und dass hiervon mehr als 163 000 Tonnen nach dem Ammoniak-Verfahren dargestellt werden.

Die folgende Zusammenstellung zeigt die Quantitäten von Ammoniak-Soda, welche Solvay seit dem 1. Mai 1866 in je zwölf Monaten producirt hat

1866—67	179	Couillet.
1867—68	465	
1868—69	719	
1869—70	940	
1870—71	1 862	
1871—72	2 805	
1872—73	3 423	
1873—74	3 980	
1874—75	4 678	
1875—76	5 768	Couillet und Dombasle.
1876—77	11 579	
1877—78	19 247	
1878—79	25 023	
1879—80	32 326	
1880—81	42 669	Couillet, Dombasle und Wyhlen.
1881—82	53 400	

Die Zahlen reichen bis zum 30. April v. J. Seitdem hat Solvay seine Production um nahezu 60 Tonnen pro Tag oder 21 000 Tonnen pro Jahr vergrössert, so dass er jetzt ca. 75 000 Tonnen jährlich darstellt. In Frankreich und Deutschland hat Solvay's grosser Erfolg andere Fabrikanten zur Nachahmung gereizt, und obwohl keiner von diesen grosse Quantitäten darstellt, beläuft sich ihre Gesamtproduction auf 35 000 Tonnen jährlich. Es werden daher auf dem Continent von 275 000 Tonnen jährlich producirter Soda 110 000 = 40 Proc. nach dem Ammoniak-Process fabricirt. Während dabei in Frankreich die Leblanc-Soda-Production sich in den letzten Jahren weder vermehrt noch vermindert hat, ist sie in Deutschland und Oesterreich noch um etwa 25 000 Tonnen gestiegen. Diese erhöhte Production des Con-

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tinents hat teilweise zur Deckung des vermehrten Bedarfs, hauptsächlich aber zur Verminderung der Einfuhr aus England gedient. Und von dieser grossen Zunahme der continentalen Soda-Production — von der vier Fünftel dem Ammoniak-Verfahren zu verdanken sind — sind zwei Drittel innerhalb der letzten fünf Jahre, ein grosser Teil davon in einem Zeitraum von nur zwei Jahren, hinzugetreten.

In England hat sich innerhalb der letzten zwei Jahre die Production von Ammoniak-Soda beinahe verdreifacht.

Der Ammoniak-Process wird daselbst bis jetzt nur von einer Firma verwertet. Vor dem Jahr 1873 war er überhaupt noch nicht eingeführt worden. In diesem Jahre erhielt L. Mond von Solvay das Recht, nach dessen Patenten zu arbeiten und im folgenden Jahr begann er mit J. T. Brunner in Winnington bei Norwich die Fabrikation einzurichten. Brunner und Mond fingen in sehr bescheidenem Maassstabe an zu produciren, indem die Quantität im Jahre 1875 nicht mehr als 2 500 Tonnen betrug; indess stieg ihre Production 1878 auf 10 000 Tonnen, 1880 auf 18 800 Tonnen und jetzt beträgt sie nicht weniger als 52 000 Tonnen im Jahr.

Solvay, welcher schon jetzt bei weitem der grösste Sodafabrikant der Welt ist, wird bald auch in Norddeutschland, in Bernburg, eine Fabrik im Betriebe haben, er errichtet ferner Fabriken in Russland und den Vereinigten Staaten und ist im Begriff, eine solche in Oesterreich anzulegen, so dass er beiläufig in nicht weniger als sieben Fabriken in sechs verschiedenen Ländern Ammoniak-Soda darstellen wird. Ausserdem wird eine grosse Fabrik für Darstellung von Ammoniak-Soda, nicht nach Solvay's System, sondern nach einer Modification des in Dieuze üblichen Verfahrens, bei Stassfurt errichtet, eine andere Ammoniak-Soda-Fabrik ist in Favorznow bei Krakau im Bau und wird im Frühjahr fertiggestellt werden, eine dritte ist in Siebenbürgen erbaut, abgesehen von dem Plane der Gebrüder Bell, eine ebensolche Fabrik in Middlesborough anzulegen. Die neuen Ammoniak-Soda-Fabriken, von denen einige fast vollendet sind, werden im Anfang nicht weniger als 65—70 000 Tonnen Ammoniak-Soda auf den Markt bringen.*)

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*) Da noch keine vollständige Liste der Ammoniak-Soda-Fabriken publicirt worden ist, dürfte es von Interesse sein, hier eine solche zu geben. Die folgenden Fabriken sind jetzt wirklich in Betrieb:

England:
Winnington, Sandbach.

Frankreich:
Dombasle, Giraud, Sorgues, St. Denis, Lille.

Deutschland:
Wyhlen, Duisburg, Inowrazlaw, Grevenberg, Dieuze, Trotha, Heilbronn, Nürnberg, Rothenfelde.

Belgien:
Couillet.

Oesterreich:
Boszko.

Vereinigte Staaten:
Bay City.

Im Bau sind Fabriken an folgenden Orten:

Oesterreich:
Favorznow, Siebenbürgen.?

Deutschland:
Stassfurt, Bernburg.

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Ausser der drohenden Concurrenz von seiten des Ammoniak-Processes hat das einfache Leblanc-Verfahren noch eine zweite zu bekämpfen, nämlich die des Leblanc-Processes selbst in Verbindung mit der Kupferextraction aus spanischen Pyriten.

Die in England verarbeiteten Pyrite stammen jetzt fast ausschliesslich aus Spanien und enthalten 2—3 Proc. Kupfer, sowie sehr kleine Mengen von Silber und Gold. Nachdem durch Rösten der grösste Teil des Schwefels in Form von schwefliger Säure gewonnen worden ist, wird der Rückstand („burnt ore" oder „pyrites cinders") auf nassem Wege auf Kupfer und meist auch auf Silber und Gold verarbeitet.**) Das nach Extraction dieser Metalle hinterbleibende Eisenoxyd ist nahezu rein und zur Eisen- und Stahl-Erzeugung sehr brauchbar. Die Gewinnung dieser Pyrite liegt zum grössten Teil in den Händen von drei grossen Gesellschaften, der Tharsis Company, der Rio Tinto Company und der Firma Mason & Barry. Diese Gesellschaften liefern nicht nur die Gesamtmenge der zur Schwefelsäurefabrikation in England erforderlichen Pyrite, sondern die Rio Tinto Company liefert jährlich auch mehr als 60 000 Tonnen nach Deutschland und beginnt auch Pyrite nach Oesterreich zu versenden. Keine der Gesellschaften hat dagegen jemals eine Spur Pyrit nach Frankreich verkaufen können.

Der Grund hiervon ist, dass Frankreich selbst zwei grosse Pyritlager besitzt, welche beide Sodafabrikanten gehören, nämlich das eine der Compagnie de St. Gobain, das andere der Firma Pechiney & Cie. Diese Fabriken verarbeiten nicht nur selbst ihre eigenen Pyrite, sondern versorgen auch alle kleineren Sodafabrikanten Frankreichs damit.

Unter diesen Umständen hat die Rio Tinto Company einen bemerkenswerten Schritt gethan. Zum Verständnis der Beweggründe muss man bedenken, dass die französischen Pyrite, weil sie kein Kupfer enthalten, abgesehen von ihrem Schwefelgehalt kaum einen Wert besitzen, während die spanischen Pyrite nicht allein in ihrem Schwefelgehalt den besten kupferfreien Pyriten gleichkommen, sondern in ihrem Kupfergehalt einen noch grösseren Wert als im Schwefel repräsentiren. Ein weiterer Wert liegt in ihrem Gehalt an edlen Metallen und an Eisen. Der Rückstand von der Röstung kupferfreier Pyrite hat in England absolut keinen Wert und wird

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Russland: Beresniki. Vereinigte Staaten: Syrakus.

Der Ort, wo Solvay seine Fabrik in Oesterreich errichtet, kann noch nicht bekannt gemacht werden.

**) Eine deutsche Analyse von Rio Tinto-Pyrit giebt folgenden Gehalt in 1000 kg an:

Schwefel	459	kg
Eisen	430	„
Kupfer	30	„
Blei	10	„
Silber	26	g
Wismut	150	„
Gold	180	mg.

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selbst in Frankreich trotz der hohen Eingangszölle auf Eisen höchstens mit 3 Francs pro Tonne bezahlt. Der geringe Wert dieses Rückstandes rührt daher, dass er stets Schwefel und bisweilen auch Phosphor enthält. Der Rückstand kupferhaltiger Pyrite enthält ebenfalls Schwefel, er wird jedoch bei der Extraction des Kupfers hiervon sowie von Phosphor, falls solcher darin war, vollkommen befreit. Das rückständige, sehr reine Eisenoxyd („purple ore") hat in England einen Preis von 12 Schilling pro Tonne und würde in Frankreich ohne Zweifel einen noch höheren erzielen.

In England hat sich im Laufe der Zeit ein Zustand herausgebildet, bei welchem die Leblanc-Sodafabrikanten von dem Kupfer- und Eisenwerte der Pyrite, welche sie verarbeiten, keinen Vorteil ziehen. Die Verarbeitung der kupferhaltigen Pyritrückstände ist daselbst eine besondere Industrie geworden, welche nur in wenigen Fällen von den Sodafabrikanten selbst betrieben wird. Die Gesellschaften oder Individuen, welche sich mit dieser Industrie befassen, kaufen entweder von den Sodafabrikanten die Rückstände der Pyrite, in welchen jene sowohl den Schwefel- wie den Kupferwert bezahlt haben, oder sie kaufen selbst beide Werte, indem sie nur den Schwefelwert den Sodafabrikanten überlassen, oder endlich, es tritt der Fall ein, dass die Pyritlieferanten dem Einen den Schwefel, dem Anderen das Kupfer ihrer Pyrite verkaufen. Während so die Sodafabrikanten nur geringen Nutzen aus den Pyriten ziehen, erzielen diejenigen, welche die Rückstände verarbeiten, beträchtlichen Gewinn. Dieser letztere würde natürlich in Frankreich, wo Eisen und Eisenerze einen höheren Wert haben, noch bedeutender sein. Allerdings sind die Kohlen in Frankreich theurer als in England, indess ist die zur Reduction der Pyritrückstände erforderliche Quantität Kohle nicht gross.

Das Unternehmen, welches die Rio Tinto Company ins Auge gefasst hat, ist folgendes. Obwohl sie ihre Pyrite an die französischen Sodafabrikanten nicht verkaufen kann, hat sie beschlossen, dass trotzdem der grösste Teil der Leblanc-Soda in Frankreich mit spanischen Pyriten fabricirt werden soll, und zu diesem Zweck eine Hilfsgesellschaft „La Compagnie d'Exploitation des Minerais de Rio Tinto" ins Leben gerufen. Diese Gesellschaft soll in Frankreich und anderswo Leblanc-Soda darstellen und ihren Gewinn weder aus der Soda, noch aus dem Chlor, sondern aus dem Kupfer und dem Eisenoxyd ziehen. Für diese Gesellschaft werden also Soda und Chlor lediglich Nebenproducte sein, welche sie, wenn es angeht, gern mit Vorteil verkaufen wird, die sie aber eventuell auch zum Selbstkostenpreise wegzugeben bereit sein wird. Sie will dieselben nur fabriciren, um die Pyrite von Rio Tinto in „pyrites cindres" zu verwandeln.

Diese neue Gesellschaft beabsichtigt, in einem enormen Maassstabe zu arbeiten. Sie hat ein Capital von 1 200 000 Pfund Sterling, wovon bereits die Hälfte gezahlt ist, und will, wie man sagt, nicht weniger als fünf grosse Fabriken errichten; eine davon ist bereits in der Nähe von Marseille angefangen worden.

Ferner will die neue Gesellschaft ihre Operationen nicht auf Frankreich

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beschränken. Sie wird nicht nur spanische Pyrite nach den Vereinigten Staaten bringen und daselbst Schwefelsäure darstellen, Kupfer extrahiren und Eisenoxyd gewinnen, von dem jetzt grosse Quantitäten von England nach Amerika gehen, sondern sie wird auch eine grosse Soda- und Kupfer-Fabrik in der Nähe von Antwerpen errichten, welche sicherlich den englischen Handel schädigen wird. Der Leblanc-Process wird so in Belgien wieder eingeführt werden, aber nicht als eigener Fabrikationszweig, sondern nur als Teil eines Verfahrens zur Nutzbarmachung kupferhaltiger Pyrite.

Um wieder auf den Ammoniakprocess zurückzukommen, so trösteten sich die Leblanc-Soda-Fabrikanten, als dieser Process sie zuerst bedrohte, mit zwei Erwägungen. Die eine war, dass der Ammoniakprocess seiner Ausdehnung selbst eine Grenze setzen würde wegen des damit unzertrennlich verbundenen Verlustes an Ammoniak. Dieser Verlust musste nothwendig eine vermehrte Nachfrage nach Ammoniak und damit ein Steigen dieses Körpers im Preise zur Folge haben. Sie wussten, dass der Preis des Ammoniaks in Folge der vermehrten Nachfrage binnen zwanzig Jahren sich verdoppelt hatte und glaubten, dass diese Preiserhöhung andauern würde, bis schliesslich der Ammoniakprocess nicht mehr gewinnbringend sein werde. Diese Voraussetzung ist keineswegs eingetroffen, denn trotz der immensen Ausdehnung des Ammoniakprocesses beginnen die Ammoniakpreise jetzt zu fallen. Die irrige Ansicht, dass es unmöglich sei, das aus Coksöfen entweichende Ammoniak aufzufangen, ohne die Coks zu verderben, ist vor den vollendeten Thatsachen verschwunden; Ammoniak wird jetzt in verkäuflichem Zustande nicht nur aus Coksöfen, sondern auch aus einer anderen, ganz unvorhergesehenen Quelle erhalten, und schon scheint die Zeit angebrochen zu sein, wo wenigstens ein Teil des Stickstoffs der Brennmaterialien, die für industrielle oder häusliche Zwecke consumirt werden, in Form von Ammoniak gewonnen und nutzbar gemacht werden wird.

In Frankreich wurde Ammoniak seit einer Reihe von Jahren aus Coksöfen gewonnen.*) Bereits vor 10—12 Jahren erbot sich Carvés, den französischen Coksfabrikanten auf seine Kosten und auch auf seine Gefahr hin Oefen zu erbauen unter der Bedingung, dass sie ihm den dritten Teil der damit erzielten Condensationsproducte überliessen. Dies Anerbieten wurde von einigen angenommen und führte zu Resultaten, die sowohl für die Coksfabrikanten, wie für Carvés ganz zufriedenstellend waren. Ganz kürzlich wurden Coksöfen nach dem System Carvés in South Durham errichtet, und nach etwa drei Monaten begann das in ihnen gewonnene Ammoniak auf dem Markt zu erscheinen.

*) Indess in keinem grösseren Maassstabe. Das einzige in Frankreich übliche System zur Ammoniakgewinnung aus Coksöfen ist das von Carvés, und dies besteht nur in drei Werken: in Tamaris, in Terre Noire und in Bessèges. Im Ganzen werden in Carvés'schen Oefen täglich 300 Tonnen Coks producirt und dabei nur 6 Tonnen Teer und Ammoniak, entsprechend 2—2½ Tonnen Ammoniumsulfat gewonnen. Die in den betr. Werken benutzte Kohle ist viel ärmer an Stickstoff, als gewöhnliche englische Kohle.

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Ein weit wichtigerer Fortschritt wurde zur selben Zeit in North Durham gemacht. Das Carvés'sche Verfahren der Coksfabrikation giebt gute Resultate, hat aber den Nachteil, dass es Coksöfen von besonderer Construction erfordert. Es könnte daher ausgedehntere Anwendung nur dann finden, wenn die bestehenden Oefen durch Carvés'sche ersetzt würden, was naturgemäs nur nach und nach geschehen könnte. Ein Verfahren zur Gewinnung von Ammoniak und anderen flüchtigen Producten aus Coksöfen, welches rasche Verbreitung finden soll, muss bei den bestehenden Coksöfen anwendbar sein. Ein solches Verfahren, welches sehr geringe Ausgaben erfordert, ist neuerdings von John Jameson in Newcastle-on-Tyne angegeben worden. Seine Methode ist beinahe sechs Monate in den Werken von H. Lee Pattinson in Felling bei Gateshead angewendet worden, und nach dessen Versicherung mit durchaus befriedigendem Erfolg. Die Condensationsproducte sind die Producte der Destillation von Kohle bei sehr niedriger Temperatur. Es wurden pro Tonne Kohle durchschnittlich 11 Gallonen Oel und 12 Pfund Ammoniumsulfat erhalten. Das Oel ist ein rohes Paraffinöl von 0·9 spec. Gew., welches 8—10 Proc., je nach der Art der benutzten Kohle, an Paraffin enthält. Die Ausbeute an Oel wird voraussichtlich nicht wesentlich mehr gesteigert werden, wohl aber die Menge des erhaltenen Ammoniaks, welches bis jetzt noch unvollkommen condensirt wird. Ausserdem werden pro Tonne Kohle 12 000—15 000 Cubikfuss brennbaren Gases gewonnen. Die Coks sind den auf gewöhnlichem Wege fabricirten in Qualität und Quantität völlig gleich. Die Kosten der Anbringung des Systems an bestehenden Coksöfen betragen nicht über 30 Lstr. pro Ofen. Es sind bereits Licenzen für Anwendung des Verfahrens auf 100 000 Tonnen Kohle jährlich erteilt, und ist alle Aussicht vorhanden, dass dasselbe rasche Verbreitung finden wird.

In den letzten Monaten hat man auch begonnen, aus den schottischen Hochöfen Ammoniak zu gewinnen. In Schottland bestehen über 120 Hochöfen, welche mit roher Kohle beschickt werden. Vor einigen Monaten hatte ein Mitglied der Firma William Baird & Co., der zugleich Director eines Gaswerkes ist, William Ferrie, die Idee, dass die Methoden zur Abscheidung von Ammoniak und Teer aus Leuchtgas auch zur Isolirung dieser Substanzen aus den Gasen der mit Steinkohle betriebenen Hochöfen dienen könnten. Obwohl das Volumen der Hochofengase pro Tonne angewandter Kohle 13 mal grösser ist, als das der aus demselben Gewicht durch Destillation erhaltenen Gase, so ist doch Ferrie's Idee mit vollkommenem Erfolge verwirklicht worden. Bei zwei der 16 Hochöfen der Gartsherrie-Eisenwerke wurden einige Monate hindurch Ammoniak und Teer in regelmässiger Weise aufgefangen, bei den übrigen 14 sind Vorbereitungen dazu im Gange. Die Menge des jetzt in Gartsherrie erhaltenen Ammoniaks entspricht ca. 18 Ctr. Ammoniumsulfat pro Tag oder 20 Pfd. Ammoniumsulfat pro Tonne verbrauchter Kohle. Die übrigen Condensationsproducte der Hochofengase ähneln mehr dem gewöhnlichen Gasteer als dem Coksofenteer. Obwohl ihr Wert noch nicht sicher bestimmt worden ist, so scheint er dem des Gasteers doch

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nahezu, wenn auch nicht ganz, gleichzukommen. Die in Gartsherrie erzielten Erfolge haben in anderen schottischen Eisenwerken dazu geführt, dasselbe Ziel auf anderem Wege anzustreben; Versuche zu diesem Zweck sind in den Eisenwerken von Monkland, Summerlee, Airdrie u. a. gemacht worden, so dass vielleicht die Zeit nicht mehr fern ist, wo aller Teer und alles Ammoniak, welche aus den schottischen Hochöfen entweichen, aufgefangen und auf den Markt gebracht werden.

Jeder dieser 120 schottischen Hochöfen consumirt durchschnittlich 50 Tonnen Kohle in 24 Stunden. Die Gesamtmenge Kohle, welche sie im Jahr verbrauchen, ist daher $50 \times 120 \times 365 = 2\,190\,000$ Tonnen. Demnach könnten aus diesen Hochöfen nahezu 20 000 Tonnen Ammoniumsulfat jährlich erhalten werden, welche nach dem gegenwärtigen Preise dieses Salzes einen Wert von 400 000 Lstr. haben würden.

So gross diese Quantität auch ist, so ist sie doch nur ein Zehntel der Menge, welche aus den englischen Coksöfen gewonnen werden kann. In England werden jährlich nicht viel weniger als 20 000 000 Tonnen Steinkohle vercokt, und wenn Jameson's System bei allen Coksöfen angewendet würde und pro Tonne Kohle eben so viel Ammoniak lieferte, wie bei den Hochöfen von Gartsherrie erhalten wurde, so würde dies Verfahren jährlich 180 000 Tonnen Ammoniumsulfat im Werte von $3^1/_2$ Mill. Lstr. ergeben. Dies ist noch nicht alles, da ich bald von einer anderen voraussichtlichen Quelle von Ammoniak zu reden haben werde, welche noch ergiebiger ist.

Der Ammoniaksoda-Fabrikant verliert nun von dem angewandten Ammoniak $^1/_{40}$—$^1/_{50}$. Da er auf 1 Aequivalent zu producirenden Natriumcarbonats $1^1/_2$—$1^3/_4$ Aequivalent Ammoniak nötig hat, so kann man annehmen, dass er für jedes Aequivalent Natriumcarbonat etwa $^1/_{23}$ Aequivalent Ammoniak verliert. Dieser Verlust entspricht ca. $5^1/_2$ Tln. Ammoniumsulfat auf 100 Tln. producirten Natriumcarbonats. Bei der Fabrikation der gegenwärtig jährlich erzeugten 163 000 Tonnen Ammoniaksoda würden also ungefähr 9 000Tonnen Ammonsulfat verloren gehen. Diese Quantität ist ohne Zweifel beträchtlich bei einem Artikel, welcher 20 Lstr. pro Tonne kostet, aber verglichen mit der Ergiebigkeit der neuen Ammoniakquellen, welche jetzt in Betracht gezogen werden, ist sie äusserst unbedeutend. Sie beträgt weniger als $^1/_{20}$ der Quantität, welche die Hochöfen und Coksöfen in Grossbritannien allein zu liefern im Stande sind. Wir dürfen daher ganz sicher sein, dass die Fortschritte der Ammoniaksoda-Fabrikation durch keine Schwierigkeiten bezüglich der Beschaffung von Ammoniak aufgehalten oder begrenzt werden können.

Die zweite Erwägung, welche den Leblanc-Sodafabrikanten eine Hoffnung auf Rettung vor dem Ammoniakprocess gewährte, war die, dass die Welt ebensowohl Chlor als Soda braucht, und dass das Chlor des Salzes beim Leblanc-Process als Salzsäure erhalten wird, welche leicht in freies Chlor übergeführt werden kann, während der Ammoniakprocess das Chlor in Form einer ziemlich verdünnten Chlorcalciumlösung liefert. Man glaubte,

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dass der Ammoniakprocess den Leblanc-Sodafabrikanten sogar nützlich sein würde, indem er die weitere Ausdehnung des Leblanc-Verfahrens und damit die Ueberproduction an Salzsäure hinderte und den Preis dieses Körpers erhöhte. Ohne Zweifel würde der Ammoniakprocess dieses Resultat bewirkt haben, wenn nicht die Production an Salzsäure in England die Nachfrage nach Chlorproducten schon so bedeutend überstiegen hätte. Obgleich die Nachfrage immer grösser wird und die Production von Salzsäure in den letzten Jahren erheblich abgenommen hat, so ist doch wegen der Gesetze über Verunreinigung der Flüsse und der Luft der Verkaufspreis der Chlorproducte in den vergangenen Jahren beständig im Fallen gewesen, so dass er jetzt kaum noch die Kosten der Darstellung deckt.

Solvay erbaut jetzt in Dombasle Apparate, um das Verfahren zur Gewinnung von Salzsäure aus Chlorcalcium, an dem er viele Jahre gearbeitet hat, im grossen durchzuführen. Bei diesem Verfahren wird die Lösung von Chlorcalcium und Chlornatrium, wie sie als Rückstand des Ammoniakprocesses erhalten wird, concentrirt, mit Thon vermengt und zu Kugeln geformt; diese werden getrocknet und in einem Dampfstrom zur Rotglut erhitzt. Die Quantität des anzuwendenden Dampfes ist dabei weit grösser, als zur Zersetzung des Chlorcalciums theoretisch erforderlich wäre. Da nun in Folge dessen eine sehr verdünnte Salzsäure resultiren würde, so will Solvay das Gemenge von Dampf und Chlorwasserstoff, bevor er es condensirt, durch eine sehr concentrirte Chlorcalciumlösung leiten, welche, wie er gefunden hat, den grössten Teil des Wasserdampfes absorbirt, dagegen das Salzsäuregas entweichen lässt. Letzteres kann dann auf die gewöhnliche Weise condensirt werden. Diese Methode ist sehr sinnreich, kann aber schwerlich wohlfeil sein. Zuerst muss eine Lösung von etwa 8 Proc. Chlorcalciumgehalt fast zur Trockne verdampft werden, dann muss das Gemenge von Chlorcalcium und Thon eine beträchtliche Zeit in einem Dampfstrom zur Rotglut erhitzt werden, endlich muss die Chlorcalciumlösung, welche zur Absorption des Wasserdampfes gedient hat, durch Abdampfen wieder zu ihrer ursprünglichen Stärke gebracht werden.

Solvay hofft, dass das Calciumsilicoaluminat, welches bei der Darstellung der Salzsäure als Rückstand bleibt, als Cement verwertet werden und dadurch die Darstellungskosten der Salzsäure ermässigen könne.

Der Export englischer Chlorproducte nach dem Continent wird noch in anderer Weise bedroht. Die Leblanc-Soda-Fabriken des Continents produciren nicht genug Salzsäure, um den Bedarf ihrer Länder zu decken.

Grosse Quantitäten von Chlorproducten gehen deshalb von England nach dem Continent, da unsere grosse Salzsäureproduction uns in den Stand setzt, nicht nur den Bedarf an Chlor in England und Amerika vollständig zu decken, sondern auch einen erheblichen Teil des continentalen Bedarfs zu befriedigen und schliesslich noch Massen von überschüssiger Salzsäure in die Nordsee fliessen zu lassen. Die Leblanc-Soda-Fabrikanten des Continents sehen den Import englischen Chlors in ihre Länder nicht gern; sie können

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ihn aber nur verhindern, wenn sie entweder ihre Production an Salzsäure vergrössern, oder wenn sie im Stande sind, aus einer gegebenen Menge Salzsäure mehr Chlor zu gewinnen, als nach dem jetzigen Verfahren möglich ist.

Was die Soda betrifft, so sind die englischen Leblanc-Soda-Fabrikanten jetzt in der Lage, dass sie, wenn nicht factisch mit Verlust, so doch wenigstens ohne Gewinn arbeiten. Bis vor kurzem deckten sie den ganzen englischen und amerikanischen Bedarf an Soda, sowie einen grossen Teil des continentalen. Jetzt sind sie sowol auf dem einheimischen wie auf dem amerikanischen Markt von englischen Ammoniaksoda-Fabrikanten bedroht, und neuerdings hat die Ammoniaksoda-Fabrikation in den Vereinigten Staaten selbst Eingang gefunden und wird noch in diesem Jahre ihre Production auf 20 000 Tonnen jährlich steigern. Binnen kurzer Zeit wird die belgische Soda- und Kupferfabrik nicht nur dem ganzen Soda-Export von England nach Belgien ein Ende machen, sondern auch Leblanc-Soda nach Amerika ausführen; dasselbe werden ohne Zweifel die grosse, in Marseille im Bau befindliche Fabrik und eventuell die in anderen französischen Seestädten zu errichtenden Fabriken thun. Die Ausfuhr englischer Soda nach Oesterreich, welche schon auf wenig mehr als 8000 Tonnen pro Jahr gesunken ist, wird voraussichtlich noch vor Ende des Jahres ganz aufhören in Folge der vermehrten Ammoniaksoda-Production in Oesterreich. Ebenso wird eine Steigerung der Production an Ammoniaksoda auch die Einfuhr englischer Soda in Deutschland unmöglich machen, welche 1881 schon nur $^2/_3$ von ihrem Werte im Jahre 1879 betrug. Russland wird bald wenigstens einen Teil der Soda, welche es verbraucht, selbst fabriciren, und Frankreich, das bis jetzt für seinen Bedarf an Aetznatron ganz von England abhängig war, obwohl es schon lange keine Soda mehr von uns bezogen hat, wird bald seinen ganzen Bedarf an Aetznatron selbst produciren. Denn, abgesehen von den erwähnten Unternehmungen der neuen Gesellschaft, fängt Herr Solvay jetzt gerade an, Aetznatron in Dombasle darzustellen und gedenkt diese Fabrikation in sehr grossem Maassstabe einzurichten.

Wie können angesichts aller dieser Umstände die englischen Leblanc-Soda-Fabrikanten weiter existiren? Für's erste ist es ganz sicher, dass sie billigere Pyrite haben müssen. Der gegenwärtige Preis derselben (6 d. pro Unit) ist ein künstlicher, der nur einer Handelscombination zu verdanken ist und sicher um 50 Proc. ermässigt werden muss. Dass diese Ermässigung möglich ist und den Verkäufern noch einen schönen Gewinn lässt, kann nicht bezweifelt werden. Bei dem jetzigen Preise des Kupfers und einem Schwefelpreise von 3 d. pro Unit würden Pyrite von $2^1/_2$ Proc. Kupfergehalt 39 sh. pro Tonne erzielen, und dass spanische Pyrite zu diesem Preis mit Vorteil nach englischen Häfen geliefert werden können, steht für mich ausser Frage. Wenn daher die bestehenden Gesellschaften sich weigern sollten, diese Pyrite für den genannten Preis zu verkaufen, so würden sich neue Gesellschaften bilden, welche dies thäten. Man kann also als sicher

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annehmen, dass mit Ende nächsten Jahres der Schwefel der Pyrite für 3 d. pro Unit zu haben sein wird.

Diese Preisermässigung würde indess die Darstellungskosten der Leblanc-Soda noch keineswegs denen der Ammoniaksoda gleichstellen. Aus den Dividenden, welche die verschiedenen Sodafabriken zahlen, kann man einen annähernden Schluss auf die Kosten der von ihnen benutzten Verfahren ziehen. Auf diese Weise ergiebt sich, dass die Leblanc-Soda-Fabrikanten überhaupt keinen Gewinn erzielen, während an Ammoniaksoda reichlich 1 Lstr. pro Tonne verdient wird. Da zur Herstellung einer Tonne Natriumcarbonat nach Leblanc's Process nur 13·5 Ctr. Pyrite erforderlich sind, so würde eine Ermässigung der Pyritpreise um 3 d. pro Unit die Darstellungskosten einer Tonne Soda nur um 7 sh. 9 d. herabsetzen.

Immerhin bedeutet diese Ersparnis viel, und um die noch bleibende Differenz der Kosten auszugleichen, giebt es zwei Mittel, welche zusammen, wie ich glaube, genügen werden, um den Leblanc-Process gegenüber dem Ammoniakprocess in Vorteil zu bringen.

Das eine dieser Mittel ist die Regeneration des Schwefels, und durch diese könnten möglicherweise die fehlenden 12 sh. 3 d. pro Tonne Natriumcarbonat allein gewonnen werden. Zu diesem Zwecke müsste, ausser an Orten, wo Bedarf an arsenfreier Schwefelsäure existirt, der Schwefel nicht in Form von Schwefelsäure, sondern im freien Zustande regenerirt werden.

Kann freier Schwefel aus Sodarückständen so billig producirt werden, und besteht eine genügende Nachfrage nach Schwefel zu solchen Preisen, dass man den regenerirten Schwefel, in hinreichenden Quantitäten, für 2 sh. 1/2 d. den Ctr. oder für 41 sh. die Tonne höher verkaufen kann, als der Selbstkosten beträgt?

Was die Nachfrage nach Schwefel betrifft, so zeigen die neuesten, von der italienischen Regierung veröffentlichten Berichte, dass die jährliche Schwefelproduction in Sicilien und Italien während der fünf Jahre 1875 bis 1879 sich auf 282 000 Tonnen belief, wovon 216 000 Tonnen ausgeführt wurden. Die Gesamtmenge des Schwefels, welcher aus den englischen Sodarückständen gewonnen werden könnte, übersteigt nicht zwei Drittel der letzteren Quantität. Die Welt consumirt also mehr Schwefel, als die englischen Sodafabrikanten produciren könnten, wenn sie auch, um ihre ganze Production zu verkaufen, einen grossen Teil des sicilianischen Schwefels vom Markt verdrängen müssten.

Der jetzige Preis des sicilischen Schwefels in Marseille beträgt bei billigstem Transport ca. 5 £ pro Tonne. Um den Schwefelmarkt zu beherrschen und zugleich an dem regenerirten Schwefel 2 sh. pro Ctr. zu verdienen, müssten also die englischen Sodafabriken den Schwefel für höchstens 2 £ pro Tonne wiedergewinnen können. Dies hält der Redner, zwar nicht bald, aber doch in nicht zu langer Zeit für möglich.

Ueber das zweite Mittel sagt W.: Es ist mir von Newcastle her eine sehr kühne, aber, wie mir scheint, ganz ausführbare Idee mitgeteilt

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worden, deren Verwirklichung ohne Zweifel von enormer Wichtigkeit nicht allein für die Sodaindustrie, sondern beinahe für jede Industrie überhaupt sein wird. Diese Idee ist, dass die Sodafabrikanten die Benutzung von Steinkohle für Heizzwecke ganz aufgeben und alle ihre Kohle in Coks verwandeln sollen, indem sie das dabei auftretende Teeröl und Ammoniak condensiren und verkaufen, die Coks selbst aber und die beim Verkoken entwickelten Gase zur Heizung verwenden. Man glaubt, dass unter diesen Umständen die Sodafabrikanten im Newcastle-District ihr Brennmaterial thatsächlich umsonst haben würden. Es werden in diesem Bezirk jährlich über zwei Millionen Tonnen sehr kleiner Kohle („Duff") producirt, welche beinahe als Abfall betrachtet wird und welche, sonderbar genug, mehr Oel liefert, als die theureren Sorten von Newcastle-Kohle, während sie zugleich sehr schöne Coks giebt, die für Oefen in chemischen Fabriken jedenfalls vollkommen brauchbar sind, besonders wenn ihre Verbrennung durch die der Coksofengase unterstützt wird. Der Wert des Oeles und Ammoniaks, welche beim Verkoken dieses „Duff" in Jameson'schen Oefen erhalten werden, ist grösser als die Kosten des „Duff" und seiner Verkokung zusammengenommen. Wahrscheinlich wird durch verbesserte Condensationsvorrichtungen die Ausbeute, wenn nicht an Oel, so doch an Ammoniak, gegen bisher noch bedeutend gesteigert werden können, so dass das gleiche Resultat auch mit gewöhnlicher Steinkohle, nicht nur im Newcastle-District, sondern auch in Lancashire erreichbar sein wird. In diesem Fall werden die Herstellungskosten der Leblanc-Soda sich in beiden Districten um nahezu den gesamten gegenwärtigen Preis des Brennmaterials ermässigen.

Es scheint mir, dass diese Idee auf beinahe alle anderen Industrien ebenso anwendbar sein muss, wie auf die Soda-Industrie, und dass der Einfluss ihrer allgemeinen Anwendung auf das materielle Wohlergehen der Menschheit alle Vorstellungen übersteigt. Diese Idee bedeutet unter anderem billigeres Brennmaterial für alle Zwecke, eine enorm gesteigerte landwirtschaftliche Production und die gänzliche Beseitigung des Rauches selbst in den betriebsamsten Mittelpunkten der Industrie.

Während bei dem Ammoniakprocess nur 150 Proc. der producirten Soda an Brennmaterial verbraucht werden, bedarf der Leblanc-Process ungefähr 350 Proc. davon. Dieser geringere Kohlenverbrauch beim Ammoniakprocess hat bisher als einer seiner Hauptvorzüge gegolten; aber ein Brennmaterial, welches nichts kostet, wird diesen Vorteil in einen Nachteil verwandeln, insofern es die Kosten der Ammoniaksoda um den Preis von $1^1/_2$ Tonne Kohle pro Tonne ermässigt, während bei der Leblanc-Soda die Ermässigung reichlich das Doppelte beträgt.

Wenn der englische Leblanc-Soda-Fabrikant überdies sicher ist, seinen Schwefel zu beiläufig der Hälfte des gegenwärtigen Preises zu erhalten, so hat er nun die sprüchwörtlichen „drei Wege" vor sich; nur muss er nicht zwischen ihnen wählen, sondern sie alle zugleich einschlagen. Er muss seine Salzsäure zu mehr Zwecken verwenden, als es jetzt der Fall ist; er muss

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seinen Schwefel regeneriren und verkaufen; er muss den grössten Teil seiner Kohle vercoken. Er wird dann nicht nur im Stande seine, sich gegen den Ammoniakprocess zu behaupten, sondern auch die Waageschale zu seinen Gunsten sich neigen zu lassen.

Schliesslich macht W. noch einige Bemerkungen über den Stand der Schwefelregeneration.

Die Versuchsanlage für das Schaffner-Helbig'sche Verfahren, welches die Firma Chance Brothers im vorigen Jahr in ihrer Fabrik zu Oldbury in Betrieb hatte, wurde im Juni oder Juli in Stillstand gesetzt, um eine neue Anlage zu errichten, die wöchentlich 300 Tonnen Sodarückstände verarbeiten sollte. Diese Anlage ist kürzlich in Betrieb gesetzt, und Hr. A. Chance wird bald einen vollständigen Bericht über ihre Erfolge mit besonderer Rücksicht auf die pecuniären Aussichten des Verfahrens erstatten.

Zur Erläuterung einiger interessanter Resultate, die in Bezug auf die Verwertbarkeit des Schaffner-Helbig'schen Verfahrens in Oldbury erhalten worden sind und deren Mitteilung mir gestattet worden ist, erinnere ich daran, dass das Verfahren aus zwei Hauptoperationen sich zusammensetzt, einmal aus der Zersetzung des Calciumsulfids der Sodarückstände durch Erhitzen mit einer Chlormagnesiumlösung, wobei einerseits Schwefelwasserstoff, andererseits eine Chlorcalciumlösung, welche Magnesiumhydrat suspendirt enthält, entsteht, sodann aus der Regeneration des Chlormagnesiums durch Behandeln der magnesiahaltigen Chlorcalciumlösung mit Kohlensäure:

$$\text{I.}\quad Ca\,S + Mg\,Cl_2 + 2\,H_2O = H_2S + Ca\,Cl_2 + Mg\,H_2\,O_2$$

$$\text{II.}\quad Ca\,Cl_2 + Mg\,H_2\,O_2 + CO_2 = Mg\,Cl_2 + Ca\,CO_3 + H_2\,O$$

Während der Erbauung ihrer neuen Anlage machten die Gebrüder Chance eine Reihe quantitativer Versuche, wobei jedesmal eine halbe Tonne Sodarückstand verarbeitet wurde, hauptsächlich um den mit dem Verfahren verbundenen Verlust an Magnesia zu bestimmen. Die Versuche ergaben interessante Resultate. Durch Anstellung einer Reihe von successiven Operationen, bei welchen immer wieder dasselbe Magnesiumchlorid zur Verwendung kam, fand Hr. F. Chance, dass der durchschnittliche Verlust an Magnesia nur 1·05 Tle. Mg O auf 100 Tle. verarbeiteten Rückstands betrug. Während nun die in Oldbury producirten Rückstände keinen nennenswerten Gehalt an Magnesia besitzen, in Folge der Verwendung eines sehr reinen Kalksteins, darf man dagegen annehmen, dass die im Newcastle-District erhaltenen Rückstände, in welchem District ein mehr oder weniger magnesiahaltiger Kalkstein angewandt wird, reichlich genug Magnesia enthalten, um den obigen Verlust ohne besonderen Zusatz von Magnesia zu compensiren. Bei den Rückständen von Newcastle hat man daher nur nötig von Zeit zu Zeit soviel Chlorcalcium zuzusetzen, als zur Verwandlung der darin enthaltenen Magnesia in Chlormagnesium erforderlich ist. Wo ein solcher Kalkstein zur Sodafabrikation nicht zu Gebote steht, würde derselbe Zweck zu erreichen sein, indem man dem Kalkstein 2—3 Proc. Dolomit zusetzt. Auch dies ist natürlich nur dann notwendig, wenn das bei dem Verfahren regenerirte Calciumcarbonat nicht

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wieder zur Sodafabrikation benutzt wird. Wenn letzteres der Fall ist, so findet überhaupt kein Verlust an Magnesia statt, da die „verloren gehende" Magnesia wieder in den Process zurückkehrt.

Die Versuche von Frederick Chance ergaben ferner die wichtige Thatsache, dass die Regeneration von Chlormagnesium und Calciumcarbonat durch Kohlensäure unter den Bedingungen, unter welchen operirt wurde, d. h. unter einem Druck von 20 Pfund pro Quadratzoll, ebenso leicht in der Wärme, wie in der Kälte vor sich geht. Man hatte angenommen, dass diese Reaction auf der Bildung von Magnesiumbicarbonat beruhe, in welchem Falle die fragliche Mischung vor der Behandlung mit CO_2 hätte abgekühlt werden müssen, was mindestens unbequem gewesen wäre. Es scheint indess, dass diese Reaction in der Tat eine Reaction zwischen $CaCl_2$ und $MgCO_3$ ist. Bestätigt wird dies Resultat durch Versuche von Dr. Hewitt, welcher einfach eine Chlorcalciumlösung mit einer aequivalenten Menge käuflichen Magnesiumcarbonats zusammenbrachte. Es wurden hierbei ca. 80 pCt. des Chlorcalciums zersetzt, und wahrscheinlich enthielt sein Magnesiumcarbonat keinen höheren Procentsatz an $MgCO_3$.

F. Chance machte ferner auf eine bemerkenswerte Thatsache aufmerksam, welche in sofern wichtig ist, als sie den Arbeitern ein einfaches Merkmal des Moments liefert, in welchem die Regeneration des Magnesiumchlorids beendigt ist. In der Mischung, welche man verarbeitet, ist stets etwas Eisensulfür enthalten, welches von der Kohlensäure nicht angegriffen wird, so lange noch eine Spur freier Magnesia vorhanden ist, welches aber zersetzt wird, sobald alle Magnesia in Carbonat übergeführt ist, wobei dann etwas Eisen in Form von Bicarbonat in Lösung geht. Das Auftreten des Eisens in der Lösung kann leicht erkannt werden, und in dem Moment, wo dies der Fall ist, weiss der Arbeiter, dass es Zeit ist, die Einleitung von CO_2 zu unterbrechen.

In Südfrankreich werden jetzt auf meine Veranlassung Versuche mit einer Modification des Schaffner-Helbig'schen Verfahrens angestellt. Das Wesentliche dieser Modification ist die Nutzbarmachung des im Seewasser enthaltenen Chlormagnesiums zur Schwefelregeneration. Die meisten französischen Fabrikanten, welche Seewasser verarbeiten, begnügen sich damit, daraus Kochsalz zu gewinnen. Dagegen behandelt Hr. Pechiney die Mutterlaugen, aus denen das Chlornatrium durch Krystallisation möglichst entfernt ist, weiter zur Darstellung von Nstriumsulfat, Magnesiumsulfat und Chlorkalium; als schliesslichen Rückstand erhält er eine gesättigte Lösung von Chlormagnesium, welche ausserdem nur noch etwas Brommagnesium enthält. Es schien mir, dass dieses Chlormagnesium gleichzeitig zur Regeneration von Schwefel aus Sodarückständen und zur Gewinnung von Magnesia als Handelsproduct dienen könnte. Wenn man indess Sodarückstände direct mit einer Chlormagnesiumlösung behandelt, so erhält man ein Magnesiumhydrat, welches durch alle die unlöslichen Verbindungen, die neben Calciumsulfid in den Rückständen enthalten sind, verunreinigt ist. Wird das Magnesiumhydrat zur Regeneration von Chlormagnesium verwandt, so ist die Gegenwart dieser

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fremden Körper nicht hinderlich; sie muss aber vermieden werden, wenn es sich nicht um Regenerirung des Chlormagnesiums, sondern um Gewinnung reinen Magnesiumhydrats für den Verkauf handelt. Zu diesem Zweck denke ich eine Reaction zu benutzen, welche von Dr. Kraushaar in Dingler's Journal 1877 publicirt worden ist; sie wurde indess zuerst entdeckt von Helbig in Aussig und von diesem bereits 1874 praktisch nutzbar gemacht. Es ist dies die Reaction, welche beim Erhitzen von Sodarückstand mit Wasser unter Druck eintritt. Es wirken dabei 2 Molecüle Calciumhydrat auf 2 Mol. Schwefelcalcium ein und liefern 1 Mol. Calciumsulfhydrat. Trennt man die entstandene Lösung des Sulfhydrates von dem Kalkhydrat und anderen darin suspendirten Körpern und lässt sie in eine Chlormagnesiumlösung fliessen, so erhält man einerseits Schwefelwasserstoff und andererseits ein nahezu chemisch reines Magnesiumhydrat. Zu erwähnen ist noch, dass bei directer Behandlung von Sodarückstand mit Chlormagnesium 1 Aequivalent $Mg Cl_2$ nur 1 Aequivalent H_2S in Freiheit setzt, während bei vorheriger Ueberführung des Schwefelcalciums in Calciumsulfhydrat auf jedes in Reaction tretende Aequivalent Chlormagnesium 2 Aequivalente H_2S erhalten werden.

Eine Zeit lang hoffte ich, dass man diese Reaction zwischen Wasser- und Sodarückstand in England würde benutzen können, um die Quantität des anzuwendenden Chlormagnesiums und folglich auch die zu regenerirende Menge dieses Körpers auf die Hälfte des jetzigen Verbrauches zu reduciren. Herr Chance war so freundlich, diesbezügliche Versuche in Oldbury anzustellen und Herr Helbig that dasselbe in Aussig; das Ergebnis beider Versuchsreihen war indess, dass diese Idee nicht oder wenigstens nicht mit irgendwie bedeutendem Vorteil anwendbar ist, wenn das gebrauchte Chlormagnesium regenerirt werden soll. Der Grund hiervon ist, dass die Gesamtmenge des in Form von Schwefelcalcium im Sodarückstand enthaltenen Schwefels beim Erhitzen mit Wasser unter Druck nur dann in Lösung geht, wenn die Quantität des Wassers ein gewisses Minimum übersteigt. Diese Quantität ist nicht so gross, um die Anwendung der Methode da zu verhindern, wo das Chlormagnesium nicht regenerirt zu werden braucht. Wo es sich aber um Wiedergewinnung des letzteren handelt, müsste diese ganze Wassermenge später verdampft werden, oder die regenerirte Chlormagnesiumlösung würde so verdünnt werden, dass sie in der Praxis nicht mehr angewandt werden kann. Die Kosten dieser Verdampfung würden aber die Ersparnis der Hälfte des Chlormagnesiums wahrscheinlich aufwiegen.

Vor kurzer Zeit hat eine zweite, in Oesterreich entdeckte Methode zur Regenerirung von Schwefel aus Sodarückständen einiges Aufsehen gemacht, nämlich das von Opl in Hruschau (Mähren) vorgeschlagene Verfahren (s. S. 55). Dieser Herr will den Rückstand mit Wasser mischen und Kohlensäure einleiten, um daraus Schwefelwasserstoff auszutreiben; der Schwefelwasserstoff soll in eine zweite Mischung von Sodarückstand und Wasser eingeleitet und von dieser unter Bildung einer Lösung von Calciumsulfhydrat absorbirt werden, welche Lösung alsdann auf verschiedene Weise weiter behandelt werden kann.

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Dieser Vorschlag scheint mir unvollkommen zu sein, unter anderem, weil ich nicht einsehe, wie man in der Praxis vermeiden soll, dass überschüssige Kohlensäure in die zweite Mischung von Sodarückstand und Wasser gelangt, daraus Schwefelwasserstoff frei macht und so zugleich Verlust und Belästigung verursacht. Sicherlich kann Herrn Opl's Methode zur Gewinnung des Schwefels der Sodarückstände in Form von Calciumsulfhydrat mit dem einfacheren Verfahren der Erhitzung mit Wasser unter Druck nicht concurriren.

Statistik.

Salzgewinnung in Deutschland im Jahre 1881/82 nach den steueramtlichen Angaben.

	Salzwerke mit bergmännischem Betrieb.	Salinen mit Siedesalzgewinnung.	Fabriken, in welchen Salz als Nebenproduct gewonnen wird.	Gewonnene feste Salzproducte: Krystallsalz Tonnen.	Anderes Steinsalz. Tonnen.	Siedesalz. Tonnen.	Viehsalzlecksteine, Pfannensteine u. andere feste Salzabfälle. Tonnen.	Zusammen Sp. 5–8 Tonnen.
1	2	3	4	5	6	7	8	9
Preuss. Prov. Sachsen	2	6	1	62 637	60 302	118 063	11 153	252 155
„ „ Hannover	—	11	—	—	—	81 989	3 991	85 980
„ „ Westfalen	—	9	1	—	—	25 801	579	26 380
„ „ Posen	1	1	—	—	49 792	21 490	318	71 600
Andere preuss. Provinzen	1	3	7	—	868	12 608	—	13 476
Zus. preuss. Dir. Bez.	4	30	9	62 637	110 962	259 951	16 041	449 591
Bayern	1	6	—	—	858	44 193	804	45 855
Württemberg	2	4	—	13	76 281	28 334	271	104 899
Baden	—	2	1	—	—	29 448	228	29 676
Hessen	—	3	—	—	—	15 520	—	15 520
Mecklenburg	—	1	—	—	—	1 681	—	1 681
Thüringen	1	6	—	—	23 467	37 590	1 383	62 440
Braunschweig	—	2	—	—	—	7 191	232	7 423
Anhalt	1	—	—	36	19 080	—	—	19 116
Elsass-Lothringen	—	7	—	—	—	47 735	—	47 735

Im Deutschen Reich betrug in metr. Centnern ausgedrückt, die

Waarengattung	Einfuhr: vom 1. Januar bis Ende December 1882.	Einfuhr: vom 1. Juli 1882 bis Ende Juni 1883.	Ausfuhr: vom 1. Januar bis Ende Juni 1882.	Ausfuhr: vom 1. Juli 1882 bis Ende Juni 1883.
an Soda, calcinirter	87 859	78 978	31 873	29 534
an Soda, roher, auch krystallisirter	104 460	89 962	31 145	29 533

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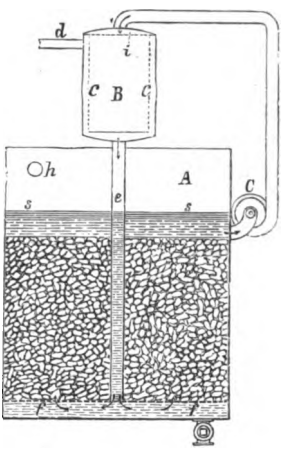
XII. Kaliumverbindungen.

W. Küsel in Stassfurt hat ein Verfahren zum Auslaugen und Lösen von Salzgemischen angegeben. (D. P. 20734 vom 5. Mai 1882.) Das Verfahren beruht auf der Thatsache, dass man durch Wasserdampf von niedrigerer Temperatur, als der Siedepunkt einer Salzlösung beträgt, letztere bis nahezu zum Sieden erhitzen kann, und bezweckt die Verwendung von Abdampf von geringer Spannung.

Fig. 42.



In das Lösegefäss *A* lässt man bei *h* die nötige Menge Löseflüssigkeit einfliessen, bis das Niveau *ss* erreicht ist. Dann setzt man die Centrifugalpumpe *C* in Bewegung, welche die Lauge in den Condensator *B* treibt. In diesen strömt durch Rohr *d* Dampf ein, welcher sich mit der durch die Siebe *icc* verteilten Lauge innig mischt. Die erhitzte Lauge fliesst continuirlich durch das Rohr *e* unter den Siebboden *f*, dringt durch die Salzmasse, wirkt lösend und strömt oben der Pumpe wieder zu.

Emil Meyer in Berlin schlägt folgenden Weg zur Darstellung von Kaliumsulfat aus Schoenit ein. (D. P. 18924 vom 22. December 1881.) Wenn eine heiss gesättigte Lösung von Schoenit mit einem Ueberschuss von Schoenitsalz kurze Zeit gekocht wird, so scheidet sich Kaliumsulfat aus und Magnesiumsulfat geht in Lösung. Man kann diese Trennung systematisch ausführen, z. B. in Shanksschen Kästen, die durch Dampf erhitzt werden. Im ersten kommt heiss gesättigte Kaliumsulfatlösung mit dem Schoenit in Berührung, aus dem letzten fliesst Magnesiumsulfatlösung ab. Durch Waschen mit geringen Mengen Wasser erhält man reines Kaliumsulfat. Die an Magnesiumsulfat angereicherte Lösung wird eingedampft bis zum Vol.-Gew. 1·33. Beim Erkalten scheiden sich Schoenitkrystalle aus. Man erhält noch einmal eine Krystallisation von Schoenit und dann scheidet sich Bittersalz aus.

Bisher hat man besonders zwei Methoden angewendet, die Carnallit-Rohsalze aufzulösen. Die eine bestand darin, dass man die Carnallit-Rohsalze unter Dampfzuströmung mit reinem Wasser löste, die andere darin, dass man kalihaltige Chlormagnesiumlaugen bei der Auflösung verwendete. Theodor Korndorff in Leopoldshall (D. P. 18845 vom 26. November 1881) verwendet zum Zwecke einer besseren und leichteren Chlorkaliumgewinnung chlorcalciumhaltige Laugen beim Auflösen der Carnallit-Rohsalze, und zwar deshalb, weil das Chlorcalcium verhindert, dass schwefelsaure Magnesia beim Auflösen mit in Lösung gehen kann, und weil die von schwefelsaurer Magnesia freien Laugen bei der ersten Krystallisation reinere

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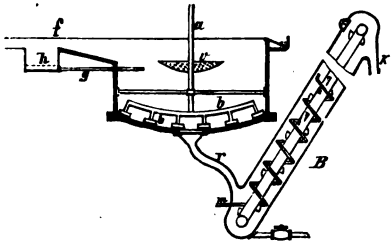
Chlorkaliumanschüsse in Bezug auf ihren Chlorkaliumgehalt geben, als solche Laugen, in welchen grössere Mengen schwefelsaure Magnesia gelöst sind. Man löst die Carnallit-Rohsalze unter Dampf, wie gewöhnlich, mit einer so gesättigten Chlorcalciumlösung, dass die schwefelsaure Magnesia, welche sich bis zu $32^1/_2°$ B. hätte lösen können, vollständig in schwefelsauren Kalk und Chlormagnesium umgesetzt werden kann.

The Mineral Salts Production and Moorlands Reclamation Company in London giebt folgendes Verfahren zur Aufarbeitung der bei der Chlorkaliumfabrikation aus Carnallit-Rohsalz resultirenden Mutterlauge von der ersten Krystallisation an. (D. P. 19256 vom 27. Juli 1881.) Nach der Ausscheidung des Chlorkaliums aus der Rohsalzlösung krystallisirt bei weiterem Eindampfen Kochsalz, welches durch Doppelverbindungen von Magnesium-, Kalium- und Natriumsulfat so verunreinigt ist, dass es nicht wohl verwendbar ist. Um das Kochsalz in reiner Form zu erhalten und Verluste an Chlorkalium zu vermeiden, wird nach diesem Verfahren aus der Mutterlauge von der Chlorkalium-Krystallisation zunächst etwas Eisen nach der Ueberführung in Oxyd durch kohlensauren Kalk gefällt, und sodann wird die Lauge mit so viel Chlorcalcium behandelt, als zur Umsetzung des vorhandenen Magnesiumsulfats erforderlich ist. Auf diese Weise können keine Doppelverbindungen des letzteren entstehen. (Vgl. oben Korndorff.)

G. G. Verzyl in Löwen, Belgien. Verfahren zur Herstellung und Reinigung des Salpeters. (D. P. 21177 vom 10. Februar 1882.) Um eine regelmässige Bildung des Productes zu erreichen, wird das Rohmaterial nur allmälig in kleinen Quantitäten in den Umwandlungs-Apparat gebracht. Der Apparat trägt an einer verticalen Welle *a* den mit einer Anzahl Schaufeln versehenen Rührer *b*, durch dessen Bewegung der gebildete Salpeter stets gegen die Mitte des Bodens geführt wird. Von da gelangt er durch das Rohr *c* in das Becher- und Schöpfwerk *B*, welches durch die Dampfschlange *m* heiss gehalten wird. Der Salpeter tritt bei *k* aus, die Lauge fliesst zurück. Das Sieb *v* dient zur Aufnahme des zu lösenden Rohmaterials. Ein Ueberfall *f* führt den Schaum auf das Filter *h*, die filtrirte Lauge fliesst durch das Rohr *g* nach dem Gefäss zurück. Die Patentschrift beschreibt noch einige andere Umwandlungsapparate.

Fig. 43.



Jacob Pontius in Elberfeld stellt saure chromsaure Salze mittelst Kohlensäure her. (D. P. 21589 vom 30. Juni 1882.) Die aus Chromeisenstein mit Kalk und Potasche erhaltene Schmelze wird mit der unten erwähnten Mutterlauge ausgelaugt. Das in der Schmelze befindliche neutrale Calciumchromat wird durch das in der Mutterlauge enthaltene Kaliumbicarbonat in Kaliumsalz umgewandelt. Die erhaltene Lösung von

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neutralem Kaliumchromat wird mit Kohlensäure unter einem Druck von mehreren Atmosphären behandelt, wobei folgende Reaction vorgeht:

$$2K^2CrO^4 + 2CO^2 + H^2O = K^2Cr^2O^7 + 2KHCO^3$$

Die von dem Kaliumbichromat getrennte Mutterlauge dient zum Auslaugen der Schmelze.

Nach einer Modification des Verfahrens wird die Schmelze mit Wasser unter Einpressen von Kohlensäure und in der Hitze ausgelaugt. Das neutrale Kaliumchromat, sowie das neutrale Calciumchromat der Schmelze wieder in die sauren Salze verwandelt und das dabei sich ergebende Kaliumcarbonat setzt sich mit dem sauren Calciumchromat zu Kaliumbichromat und Calciumcarbonat um. Die Lösung enthält also nur Kaliumbichromat und wird zur Krystallisation gebracht.

In ähnlicher Weise werden das Natriumbichromat und das saure chromsaure Calcium gewonnen. Aus letzterem lassen sich durch Umsetzung mit den entsprechenden Sulfaten Kalium- oder Natriumbichromat darstellen, durch Zusatz von Magnesia oder Magnesiumcarbonat und Behandeln des Gemisches mit Kohlensäure auch Magnesiumbichromat.

Statistik.

Im Deutschen Reich betrug, in Meter-Centnern ausgedrückt, die

Waarengattung	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an Potasche	20 316	18 828	75 316	80 131
an Chilisalpeter	1 269 184	1 571 205	21 363	15 341
an anderem Salpeter, roh und gereinigt	32 971	23 266	67 532	66 002

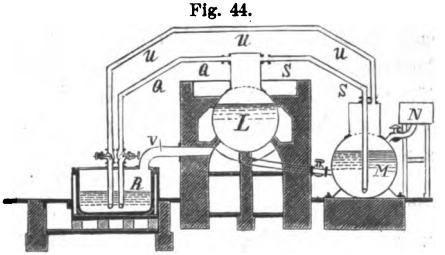
XIII. Ammoniak.

I. Ammoniak aus Gaswasser.

Es sind mehrere Apparate zur Verarbeitung von Gaswasser auf Ammoniak hervorzuheben.

Der Apparat von Georg Wunder in Leipzig (D. P. 17411 vom 14. Juni 1881) besteht aus zwei Kesseln mit zwei getrennten, nach dem Schwefelsäurebehälter führenden Dampfrohrleitungen, wobei die Gewinnung der flüchtigen Ammoniakverbindungen, ferner die Zersetzung der nicht flüchtigen Ammoniakverbindungen durch Kalkzusatz und die Ge-

Fig. 44.



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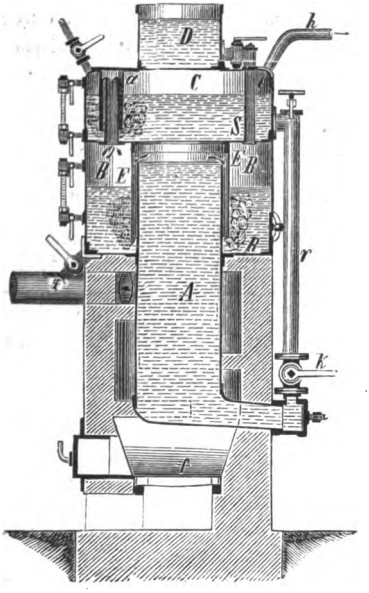
winnung des Ammoniaks aus denselben in getrennten Operationen durchgeführt wird. Das Anbrennen von Kalk an den Kesselwänden ist ausgeschlossen, da der Kalkkessel durch Dampf erhitzt wird. Im Kessel *L*, der über einer Feuerung liegt, werden die flüchtigen Ammoniakverbindungen ausgetrieben und durch Rohr *Q* in die im Kasten *R* befindliche Schwefelsäure geleitet. Dann wird der Inhalt des Kessels *L* durch Rohr *O* in den Kessel *M* geschafft, wo die nicht flüchtigen Ammoniakverbindungen durch Kalk (der als Milch aus *N* kommt) zersetzt werden. Dieser Kessel hat keine Feuerung, sondern wird durch die aus *L* durch Rohr *S* kommenden Wasserdämpfe erhitzt. Das hier entwickelte Ammoniak wird durch Rohr *U* in die Schwefelsäure in *R* geleitet.

Bei dem Apparat von Jacob Gareis in Deutz (D. P. 21707 vom 17. Februar 1882) besteht der Kessel aus den vier Behältern *A*, *B*, *C* und *D*, die teilweise durch Röhren, teilweise direct in Verbindung mit einander stehen und von denen nur der Behälter *A* durch directes Feuer von *f* aus geheizt wird. Die aus der in *A* befindlichen Flüssigkeit sich entwickelnden Dämpfe und Gase strömen zwischen dem Cylindermantel *E* und dem Behälter *A* hindurch auf den Boden des Behälters *B* durch die mit Kalkmilch versetzte Flüssigkeit, bringen dieselbe zum Sieden und entweichen mit Ammoniak stark bereichert durch Rohr *g* und *a*, gelangen auf den Boden des mit frischer Flüssigkeit gefüllten Behälters *C*, wärmen diese beim Durchstreichen vor, während der Wasserdampf sich grösstenteils in derselben condensirt, und werden durch Rohr *h* nach einem Absorptionsgefäss abgeleitet. Ist die Flüssigkeit in *B* völlig erschöpft, so wird sie durch Hahn *i* abgelassen, durch Rohr *r* und Hahn *k* wird die vorgewärmte Flüssigkeit aus *C* nach *A* eingelassen, während diejenige aus *A* durch den Rohrmantel *E* in den Behälter *B* überfliesst und hier mit Kalkmilch, die aus Behälter *D* durch Röhre *S* eintritt, vermischt wird. Nach *C* lässt man aus einem höher gelegenen Behälter frische Flüssigkeit ein, und die Destillation beginnt von neuem.

Fig. 45.



Der Apparat von A. Feldmann in Barmen (D. P. 21708 vom 12. März 1882) ist folgendermaassen eingerichtet: Aus dem Bassin und durch einen nach dem Princip des Gegenstromes eingerichteten Vorwärmer hindurch ge-

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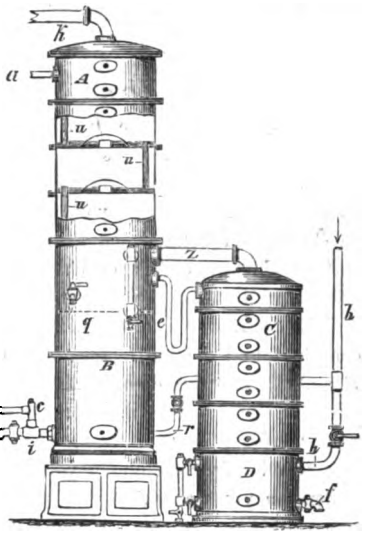
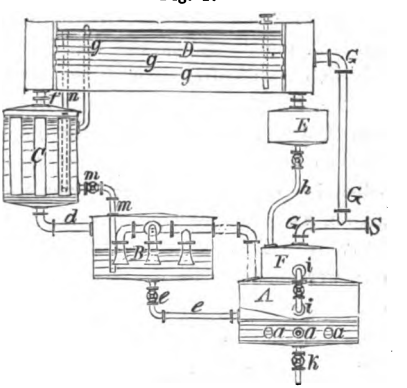
langt die ammoniakhaltige Flüssigkeit durch Rohr *a* in die obere Abteilung der Colonne *A* und von hier durch in den Böden der Abteilungen derselben angeordnete Ueberlaufsrohre *u u* nach abwärts und schliesslich durch ein längeres Ueberlaufrohr in das Zersetzungsgefäss *B*, in welches aus einem nebenstehenden Bassin vermittelst Druckpumpe durch Rohr *c* Kalkmilch eingeführt wird. In dasselbe wird am Boden durch Rohr *r* Dampf aus der Leitung *h* eingeleitet, welcher aus einem rotirenden Dampfkreisel ausströmt. Das durch Sieb *q* geklärte zersetzte Ammoniakwasser tritt durch Ueberlaufrohr *c* in die Colonne *C* ein, fliesst durch die einzelnen Abteilungen derselben nach abwärts, während durch Rohr *h* Dampf von unten einströmt. Die erschöpfte Flüssigkeit wird durch Hahn *f* abgelassen. Der ammoniakhaltige Dampfstrom tritt aus Colonne *C* durch Rohr *Z* in das Zersetzungsgefäss *B*, von hier durch die Colonne *A* und durch Rohr *k* behufs Absorption in ein Säuregefäss. Die nicht absorbirten Gase werden dort in einer Glocke aufgefangen und aus dieser durch den Vorwärmer hindurch, in welchem sich der Wasserdampf völlig condensirt, unter den Feuerrost geführt.

Fig. 46.



C. H. Schneider in Freiburg i. B. hat folgenden Apparat zur Gewinnung von Ammoniak angegeben (D. P. 21252 vom 31. Mai 1882). Geringe Mengen ammoniakalischer Flüssigkeit mit nur wenig sich als Niederschlag absetzenden Beimengungen werden in dem Apparat (Fig. 47) verarbeitet. Die im Destillationskessel *A* enthaltene Flüssigkeit wird durch Dampf erhitzt. Die entweichenden Dämpfe treten in den zweiten Destillationskessel *B*. Die aus diesem entweichenden Wasser- und Ammoniakdämpfe werden durch die Rohrleituug *d* nach dem Dephlegmator *C* geführt. Die Austrittsöffnungen für die Dämpfe in *B* sind glockenförmig, in Folge dessen das Wallen der Flüssigkeit befördert wird. Im Dephlegmator *C*, welcher

Fig. 47



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durch später zu verarbeitende Flüssigkeit gekühlt wird, werden die aus *B* kommenden Wasserdämpfe zum Teil condensirt; das Condensationswasser wird nach *B* zurückgeführt, während die nicht condensirten Dämpfe durch *f* nach dem Condensator *D* entweichen. Aus den geneigten Röhren *g* desselben fliessen die condensirten ammoniakalischen Wässer nach der Vorlage, während die nicht verdichteten Ammoniakdämpfe aus dem Condensator *D* durch die Rohrleitung *G S* nach einem Säurekasten gelangen.

Das in der Vorlage *E* während einer Charge angesammelte Ammoniakwasser wird am Ende derselben durch die Rohrleitung *h* nach dem Rectificator *F* abgelassen, welcher mit seinem Boden unmittelbar auf dem Destillationskessel *A* ruht und von diesem aus derart erwärmt wird, dass aus der im Rectificator befindlichen Flüssigkeit kein Wasserdampf, wohl aber Ammoniak entweicht, welches durch die Rohrleitung *G S* nach dem Säurekasten geleitet wird. Nach Beendigung einer Charge lässt man die erschöpfte Flüssigkeit aus *A* durch *K* ab, die Flüssigkeit aus *F* durch *i* und aus *B* durch *e* nach *A* und die im Dephlegmator *C* vorgewärmte Flüssigkeit durch *m* nach *B* ab, während aus dem Condensator Kühlflüssigkeit nach dem Dephlegmator durch *n* eingeführt wird. Der Condensator *D* wird mit neuer zu verarbeitender Flüssigkeit gefüllt.

Sind grössere Mengen von Flüssigkeiten, die schlammige Niederschläge bilden, zu verarbeiten, so wird der Condensator nach vorn geneigt und an seiner tiefsten Stelle mit einem Schlammsammler versehen und der Apparat für continuirlichen Betrieb eingerichtet.

Setzen die Flüssigkeiten sehr viel Schlamm ab, so wendet man zwei senkrecht und über dem Destillationskasten stehende Condensatoren an, die in geeigneter Weise unter einander und mit den übrigen Apparaten verbunden sind. Hat man grössere Mengen ammoniakarmer Flüssigkeit zu verarbeiten, so wird zwischen Sammelkessel und Dephlegmator noch ein Centrifugalzerstäuber und eventuell auch ein Vorwärmer angebracht. Sollen Fäcalien auf Ammoniak verarbeitet werden, so werden dieselben vorher mit desinficirenden Stoffen und Klärmitteln vermischt und in einen Klärbehälter gebracht, um die festen von den flüssigen Bestandteilen zu trennen.

Ein transportabler Kessel zur Verarbeitung von Gaswasser rührt von Fr. Gerold in Zwickau und M. Vacherot in Dresden her (D. P. 21821 vom 2. Juli 1881). Der Apparat dient dazu, Gaswasser in getrennten Gasfabriken in einem und demselben Kessel auf Ammoniak zu verarbeiten. Derselbe ist ein gewöhnlicher Cylinderkessel mit Feuerrohr *B*, Rost *C* und Zügen, welche den Kessel von aussen umgeben, und aus denen die Feuergase durch Esse *D* entweichen. Sie sind innen mit Chamotteplatten *d* belegt und werden durch an der Stirnwand angebrachte Mannlöcher gereinigt. Auf dem Kessel befindet sich ein kleiner Dom *E* mit Sicherheitsventil *f* und Abgangsrohr für die Ammoniakgase. *G* ist das Eingangsrohr mit Bleiventil für das Gaswasser, *H* das Eingangsrohr mit Hahnverschluss für die Kalkmilch, und *J* ist der Ablasshahn für das rückständige Wasser. *K K* sind Mann-

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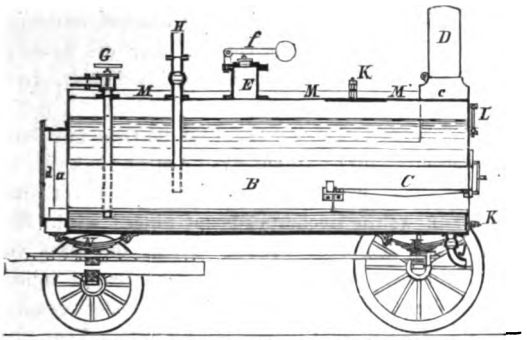
Fig. 48.



lochdeckel zum Reinigen des Kessels und *L* ist ein Wasserstandszeiger. Die freiliegende cylindrische Oberfläche des Kessels wird so viel als möglich mit Wärmeschutzmasse *M* belegt. Dieser so armirte Kessel ruht durch vier Federn *N* auf einem zum Fahren eingerichteten Gestell.

Alex. Mc. Dougall in Penrith (Engl. P. 202 vom 14. Januar 1882) behandelt Gaswasser, gefaulten Urin oder dergl. mit einer Mischung von Sägemehl, gebrauchter Gerberlohe oder Torf mit Calcium- oder Magnesiumsulfat oder -chlorid, damit sich Ammoniumsulfat bezw. -chlorid und die Carbonate der alkalischen Erden bilden.

Henry Bower in Philadelphia gewinnt neben Ammoniak auch Eisenferrocyanid aus Gaswasser (Engl. P. 2918 vom 20. Juni 1882). Das im Gaswasser enthaltene Cyanammonium wird durch Zusatz der bestimmten Menge Eisen oder Eisensalz in Ferrocyanammonium umgewandelt. Oder das klare Gaswasser wird durch eine Schicht Eisenspäne filtrirt. Die Flüssigkeit wird dann mit Kalk versetzt; das Ammoniak wird abdestillirt, und aus der Lösung wird nach dem Absetzen und Neutralisiren Berliner Blau gefällt.

Nach Peter Spence in Manchester (Engl. P. 1494 vom 28. März 1882) werden die Gase, die nach der Absorption des aus Gaswasser gewonnenen Ammoniaks durch Schwefelsäure übrig bleiben, Wasserdampf, Kohlensäure und Schwefelwasserstoff, zunächst durch eiserne Kühlröhren geleitet, wo der Dampf condensirt wird. Der Schwefelwasserstoff wird dann verbrannt, indem die Gase in die Oefen geleitet werden, wo die geschwefelte Gasreinigungsmasse verbrannt wird, um zur Fabrikation von Schwefelsäure zu dienen.

II. Ammoniak aus Ofengasen.

W. Young in Peebles und G. T. Beilby in Midcalder (Engl. P. 1377 vom 21. März 1882) beschreiben Vorrichtungen, in welchen Steinkohle, Schiefer und andere bituminöse Materialien bei Luftabschluss destillirt und die zurückbleibenden Coks mit Dampf erhitzt werden, wobei die Wärme des zur Ammoniakentwickelung aus den Coks benutzten Dampfes zur Destillation der übergegangenen Teeröle benutzt wird.

Gavin Chapman in Glasgow verfährt nach dem Engl. P. 5523 vom 17. December 1881 so, dass die Gase durch einen Raum geführt werden, in welchem ein System durchlöcherter Scheiben angeordnet ist. Diese Oeffnungen, durch welche die Gase streichen müssen, sind so angebracht, dass

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dem durchbohrten Teil einer Scheibe ein voller Teil der nächsten gegenübersteht. Die Scheiben sitzen auf einer rotirenden Welle und tauchen mit ihrem untern Teile in das die Säurelösung enthaltende Gefäss. Der die Scheiben überdachende Deckel des Gefässes taucht ebenfalls in die Flüssigkeit, deren verdampfendes Wasser zeitweilig ersetzt wird.

F. J. Bolton und J. A. Wanklyn in London benutzen die Gase aus Coksöfen, Hohöfen u. s. w. folgendermaassen zur Gewinnung von Ammoniaksalzen und künstlichen Düngern. (Engl. P. 2709 vom 9. Juni 1882.) Die Gase werden durch Röhren geleitet, in welche Hochdruckdampf injicirt wird. Hier werden die Gase abgekühlt und von Teer befreit. Wenn die Gase viel Russ enthalten, so werden in den ersten Röhren, in welche Dampf injicirt wird, parallel zur Axe der Röhre Platten von Drahtnetzen oder gewellte Platten angebracht, so dass diese leicht samt darauf abgelagertem Teer und Russ herausgenommen werden können. Die Gase werden dann durch Schichten von Superphosphat oder Gips oder Coks geleitet, welche mit Schwefelsäure befeuchtet sind. Ammoniakreiche Gase werden erst über flache mit Schwefelsäure gefüllte Bleibehälter geleitet. Eine Anwendung dieser Erfindung besteht in der Verwertung der Haufen von Kohlenabfällen.

Um das Leuchtgas von Ammoniak zu befreien und letzteres als schwefelsaures Ammoniak zu gewinnen, wird nach Vorster & Günebeeg in Kalk bei Cöln (D. P. 21837 vom 8. August 1882) mit Schwefelsäure getränkte Infusorienerde oder Flugasche auf Horden ausgebreitet, über die das Gas hinweg geleitet wird.

III. Ammoniak aus Luft-Stickstoff.

L. Mond in Northwich, Cheshire, giebt im Engl. P. 433 vom 28. Januar 1882 und D. P. 21175 vom 31. Januar 1882 Verbesserungen an dem Verfahren von Marguerite und Sourdeval an. Bariumcarbonat und Kohle werden in einer Stickstoffatmosphäre erhitzt und das entstandene Cyanbarium wird durch Erhitzen im Wasserdampfstrom in Ammoniak und Bariumcarbonat zersetzt.

Witherit wird mit Coks oder Holzkohle und Pech zu Briquettes geformt, die zweckmässig vorerst in einer reducirenden Flamme erhitzt werden, bis das Pech vercokt ist und das Bariumcarbonat seine Kohlensäure verloren hat. Dann wird die Masse in einem Ringofen gebrannt. Die mit Briquettesbruchstücken gefüllte Kammer wird mittelst eines etwa 1400° heissen Gasstromes, welcher möglichst reich an Stickstoff, möglichst arm an Kohlensäure, Sauerstoff und Wasserdampf ist, erhitzt. Als Gase eignen sich besonders die aus den Kohlensäure-Absorptionsapparaten der Ammoniak-Sodafabrikation entweichenden. Nachdem dieselben in den vorhergehenden Ringofenkammern die cyanidhaltigen Briquettes abgekühlt und sich selbst dabei vorgewärmt haben, werden sie in einem Siemens'schen Regenerator auf die erforderliche Temperatur gebracht und gelangen dann in die zu erhitzende Kammer. Nachdem genügend Cyanid gebildet ist, wird der heisse Gasstrom unter-

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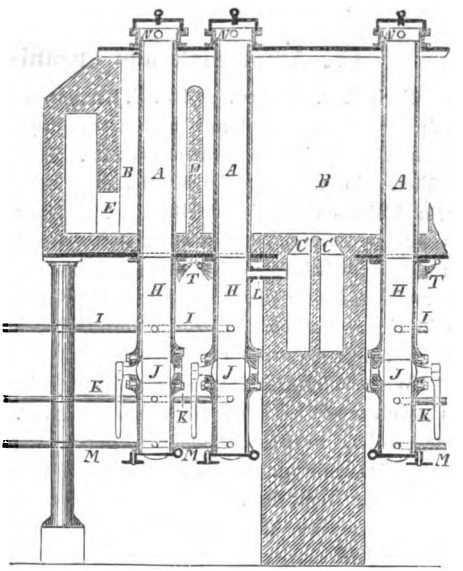
brochen und kaltes Gas von derselben Zusammensetzung eingeleitet, bis die Temperatur auf 500° gesunken ist. Dann wird Dampf eingeleitet und das entstehende Ammoniak wird mittelst eines Aspirators abgesaugt. Wenn man die Cyanverbindungen selbst gewinnen will, so muss die Abkühlung bis auf unter 300° fortgesetzt werden.

Nach einem anderen, für kleinere Anlagen geeigneten Verfahren kommen die Briquettes in Thonretorten *A*, von denen eine grössere Anzahl sich in dem Heizraum *B* befindet. Der untere Teil *H* dieser Retorten ist aus Eisen und ragt unten aus dem Heizraum heraus. Die aus dem Regenerator durch die Oeffnungen *C C* kommenden Heizgase und Luft umspülen, durch die Zwischenwände *D* geleitet, die Retorten und werden durch die Oeffnung *E* nach dem Regenerator zurückgeführt. In die etwa 1400° heissen Retorten werden durch die Röhren *I* stickstoffreiche Gase geführt. Diese Gase kühlen das in dem Teil *H* befindliche Material ab und kommen heiss in den Teil *A*, wo die Cyanidbildung vor sich geht. Man kann auch heisse Generatorgase durch den Ansatz *L* einführen. In diesem Falle braucht nicht so viel Wärme durch die Retortenwände auf das Material in *A* übertragen zu werden. Die kohlenoxydhaltigen Gase, welche die Retorten bei *N* verlassen, können verbrannt und als Wärmequelle benutzt werden. Von Zeit zu Zeit wird nach Abschluss des Hahnes *J* eine Charge von dem Boden der Retorte *H* gezogen und oben in *A* neues Material eingeführt. Das *H* verlassende Material muss auf unter 300° abgekühlt sein. Die Abkühlung des Teiles *H* kann durch Wasser aus den Brausen *T* befördert werden. Die herausgenommene Masse wird dann in einem besonderen Apparat behandelt. Man kann die Ammoniakbildung aber auch in der Retorte selbst vornehmen, sobald das unterhalb des Hahnes *J* befindliche Material auf 500° abgekühlt ist. Der Hahn wird dann zum Abschluss gedreht und in den unteren Teil wird durch Rohr *K* Dampf eingeleitet. Das Ammoniak tritt durch Rohr *M* aus.

Fig. 49.



Die gebrauchte Masse wird wiederum mit Kohle etc. zu Briquettes ge-

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formt. Ein Zusatz von Strontium-, Calcium- oder Magnesiumcarbonat macht dieselben schwerer schmelzbar.

Frederick Twinch in Paris hat folgendes Verfahren patentirt. (Engl. P. 3712 vom 25. August 1881.) Der Sauerstoff der Luft wird durch Stickoxyd fortgenommen, und der Stickstoff soll sich dann mit Wasserstoff im Entstehungszustand verbinden. Ein Cylinder, welcher mit einem Dampfmantel versehen ist, wird mit granulirtem Zink, welches zweckmässig mit einer dünnen Kupferschicht bedeckt ist, beschickt. Eine Röhre führt Dampf und Luft in den Cylinder, eine andere Stickoxyd, eine dritte Natronhydrat. Am unteren Ende wird die alkalische Zinkoxydlösung, die Ammoniaklösung und Ammoniakgas abgezogen. Es soll kein uncondensirbares Gas entweichen. Ueber die Erzeugung des Stickoxyds und Verarbeitung der alkalischen Lösung wird nichts gesagt.

IV. Ammoniak aus organischen Stoffen.

Nach J. P. Rickman und J. B. Thompson in London (Engl. P. 3305 vom 12. Juli 1882) werden Harn und Excremente mit in Fäulnis befindlicher Ochsengalle (Mucin) als Ferment versetzt. Der obere Raum des geschlossenen Behälters, in welchem die Massen sich befinden, steht in Verbindung mit einem kleineren luftdichten Behälter, welcher Schwefelsäure zur Absorption des infolge der Gährung entwickelten Ammoniaks enthält. Die Flüssigkeit aus dem Gährbehälter wird dann bei niedriger Temperatur der Destillation unterworfen, indem die Dämpfe aus einer geheizten Destillirblase erst durch die in einem zweiten nicht erwärmten Gefäss befindliche Flüssigkeit streichen und dann zur Absorption gelangen.

Will und Henry Marriott in Huddersfield. Gewinnung von Ammoniak aus stickstoffhaltigen Stoffen. (Engl. P. 4369 v. 7. Oct. 1881.) Wolle, Haar, Leder, tierische Abfälle u. dergl. werden in einer sauerstofffreien Atmosphäre zersetzt. In einem Cupolofen wird Kohle oder Coks in Luft und Wasserdampf verbrannt. Die Verbrennungsgase werden über den Boden eines zweiten Cupolofens geführt, welcher die stickstoffhaltigen Substanzen enthält. Die Gase treffen hier einen Strom von Luft, deren Sauerstoff kaum hinreicht, ihr Wasserstoff- und Kohlenoxydgas zu verbrennen, so dass hier die nötige Zersetzungstemperatur aufrecht erhalten bleibt. Die Gase aus diesem Ofen werden wie gewöhnlich durch ein Absorptionsgefäss geleitet.

Hubert Grouven in Büchen hat Neuerungen in seinem Verfahren und an den Apparaten zur Darstellung von schwefelsaurem Ammoniak aus dem Stickstoff der Bruchmoore oder Grünlandmoore angegeben. (D. P. 18051 vom 25. October 1881.) Das früher beschriebene Verfahren*) ist insofern abgeändert, als zur Veraschung der Moorsubstanz nicht glühender Wasserdampf allein, sondern ein Gemisch von Dampf und Luft genommen wird. Beim Moor liegt die Grenze des Luftzulasses bei 60 Proc., d. h. man

*) Techn.-chem. Jahrb. 1880 S. 168, 1882 S. 138, 1883 S. 78.

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darf 60 Proc. der Moorsubstanz mit Luft oxydiren, ohne dass sich Stickgas bildet. Bei Ueberschreitung dieser Grenze erleidet man eine beträchtliche Einbusse an Ammoniak. Von den 66 Proc. Wasser, die, in dem Moor enthalten, in den Cinirofen kommen, wird etwa $^1/_5$ zersetzt; der Rest entweicht als Dampf und schützt das gebildete Ammoniak vor weiterer Zersetzung. Der

Fig. 50.

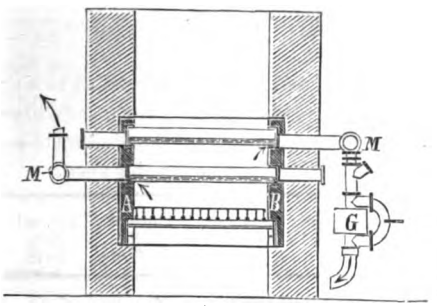
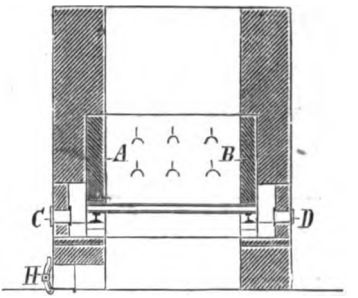


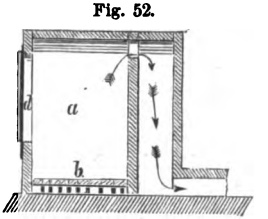
Fig. 51.



Cinirofen mit Chamottewand AB ist nun so eingerichtet, dass die Verbrennungsproducte aus der untern Feuerzone (Kohlensäure, Kohlenoxyd, Wasserstoff, Kohlenwasserstoffe, Ammoniak, organische teerbildende Dämpfe, Stickstoff und überschüssiger Wasserdampf) durch einen Körting'schen Exhaustor abgesogen und in den „Ammoniumofen" befördert werden, wo die organischen Dämpfe in Kohlensäure, Kohlenoxyd und Wasserstoff umgewandelt werden. Der Luftsauerstoff wird in dem Cinirofen vollständig verbraucht. Von der Feuerzone durch eine Reihe eiserner Kappen getrennt liegt die Verdampfungszone. Der hier langsam und stetig aus der Moorsubstanz entwickelte Wasserdampf wird auch durch einen Exhaustor G abgesogen, der zugleich das vorher berechnete Volumen der zur Verbrennung bestimmten Luft aussaugt und das Gemisch durch einen Ueberhitzungsapparat treibt. Hier auf 300° erhitzt, kommt dasselbe weiter unter den eigentümlich construirten Rost des Cinirofens.

E. Ernst in Halberstadt hat Neuerungen in seinem Verfahren zur Gewinnung von Ammoniak und Schlempekohle aus Melasserückständen angegeben. (D. P. 18549 v. 4. August 1881.)*) Der Verkohlungsofen hat folgende Einrichtung erhalten. Auf die rostartige Ofensohle wird eine 10—15 cm hohe Schicht Brennmaterial gebracht, und dieses wird von einem seitlich angebrachten Feuerrost aus entzündet. Durch die Oeffnung d wird dann nach und nach in schwachen Schichten das Vergasungsmaterial eingetragen, wobei man eine Flammenbildung zu vermeiden hat. Die Oeffnung d wird gemäs des Wachsens der Beschickung zugemauert. Die abziehenden Gase werden von unten nach oben durch einen Coksturm geleitet, wo sie einem Säurestrom begegnen.

Fig. 52.



*) Techn.-chem. Jahrb. 1883 S. 77.

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H. Y. und E. B. Castner in New-York. Fabrikation von Ammoniak und Knochenkohle. (Engl. P. 4057 vom 24. August 1882.) Die zerkleinerten Knochen werden continuirlich durch einen erhitzten geschlossenen Cylinder geführt und gelangen dann, ohne mit der Luft in Berührung zu kommen, in einen luftdichten Behälter. Die Destillationsproducte aus dem Cylinder werden mit Luft zusammen durch erhitzte Röhren geleitet, alsdann über Kalkhydrat und dann nach dem Erkalten von Säure absorbirt.

(S. auch das Capitel „Zucker".)

G. Lunge hat Herrn J. H. Smith veranlasst, die Volumgewichte der Lösungen von Ammoniak und kohlensaurem Ammoniak aufs neue zu bestimmen. (Chem. Ind. 1883, S. 2.) Folgende Tabelle zeigt die für Ammoniak erhaltenen Werte zugleich mit den bisher darüber bekannten Angaben.

Spec. Gewicht bei 14° C.	Procent NH_3 Smith	Procent NH_3 Carius	Procent NH_3 Wachsmuth	Procent NH_3 Otto	Procent NH_3 Ure	Procent NH_3 Dalton	Procent NH_3 Davy
0·8933	31·0	31·8	29·9	—	27·8	24·0	27·6
0·9116	23·8	24·6	23·8	—	23·1	19·5	23·6
0·9246	20·4	20·2	19·7	—	19·4	16·4	19·8
0·9400	15·6	15·4	15·0	—	14·7	12·9	15·5
0·9536	11·7	11·7	11·3	11·5	11·3	10·2	11·8
0·9780	5·1	5·2	4·9	5·2	5·0	4·5	—

In Bezug auf kohlensaures Ammoniak ($NH^4 \cdot HCO^3 + NH^4 \cdot CO^2 \cdot NH^2$) wurden folgende Resultate erhalten.

Kohlens. Ammoniak Procent	Specifisches Gewicht bei 15°	Ausdehnung Coefficient für 1° C.	Kohlens. Ammoniak Procent	Specifisches Gewicht bei 15°	Ausdehnung Coefficient für 1° C.
44·90	1·1414	0·00058	21·58	1·0728	0·00050
42·65	1·1362	0·00065	19·83	1·0672	0·00050
40·23	1·1297	0·00063	17·88	1·0606	0·00046
38·06	1·1230	0·00059	15·95	1·0543	0·00048
35·85	1·1174	0 00063	14·75	1·0497	0·00045
33·95	1·1115	0·00058	12·50	1·0421	0·00043
31·74	1·1049	0·00061	9·96	1·0337	0·00039
29·74	1·0995	0·00060	8·20	1·0274	0·00034
27·93	1·0937	0·00065	6·58	1·0219	0·00031
25·71	1·0863	0·00056	4·75	1·0155	0·00026
23·62	1·0795	0·00056	2·36	1·0071	0·00022

In folgender Tabelle ist aus diesen Resultaten für die specifischen Gewichte in bestimmten Intervallen (entsprechend Graden des Twaddle'schen Aräometers) der Procentgehalt durch Interpolation berechnet. Der Factor in der vierten Spalte ist aus dem Expansions-Coefficienten berechnet und zeigt, um wie viel man für 1° C. das specifische Gewicht vergrössern oder verkleinern muss.

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Grade Tw.	Specifische Gewicht bei 15°	Procent kohlens. Ammoniak	Veränderung der spec. Gewichte für + 1° C.	Grade Tw.	Specifisches Gewicht bei 15°	Procent kohlens. Ammoniak	Veränderung der spec. Gewichte für + 1° C.
1	1·005	1·66	0·0002	16	1·080	23·78	0·0006
2	1·010	3·18	0·0002	17	1·085	25·31	0·0006
3	1·015	4·60	0·0003	18	1·090	26·82	0·0007
4	1·020	6·04	0·0003	19	1·095	28·33	0·0007
5	1·025	7·49	0·0003	20	1·100	29·93	0·0007
6	1·030	8·93	0·0004	21	1·105	31·77	0·0007
7	1·035	10·35	0·0004	22	1·110	33·45	0·0007
8	1·040	11·86	0·0004	23	1·115	35·08	0·0007
9	1·045	13·36	0·0005	24	1·120	36·88	0·0007
10	1·050	14·83	0·0005	25	1·125	38·71	0·0007
11	1·055	16·16	0·0005	26	1·130	40·34	0·0007
12	1·060	17·70	0·0005	27	1·135	42·20	0·0007
13	1·065	19·18	0·0005	28	1·140	44·29	0·0007
14	1·070	20·70	0·0005		1·1414	44·90	0·0007
15	1·075	22·25	0·0006				

Statistik.

Im Deutschen Reich betrug, in Meter-Centnern ausgedrückt, die

Waarengattung	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an Ammoniak (kohlensaurem), Salmiak, Salmiakgeist . . .	7 830	6 480	7 007	8 708
an Ammoniak (schwefelsaurem)	341 175	279 611	1 042	1 208

XIV. Alkalische Erden.

I. Baryt und Strontian.

Ludwig Mond in Northwich. Darstellung der Superoxyde von alkalischen Erden und von Wasserstoff. (Engl. P. 1683 vom 6. April 1883.) Wasserstoffsuperoxyd soll für Bleichzwecke namentlich durch Calciumsuperoxyd ersetzt werden. Zur Gewinnung aller der Peroxyde wird immer zuerst Bariumsuperoxyd dargestellt. Blöcke aus Bariumcarbonat, Pech, Kohle, zweckmässig unter Zusatz von Magnesia, um sie weniger schmelzbar zu machen, werden in dem oberen Teil eines Cupolofens auf etwa 1200° erhitzt, und in den unteren Teil des Ofens wird Luft von 400 bis 500° eingeführt. Indem der in der heissesten Ofenzone entstandene Aetzbaryt nach unten sinkt, kühlt er sich bis auf 550° ab und beginnt dann Sauerstoff zu absorbiren, was bis zu einer Temperatur von 450° dauert. Das Superoxyd wird unten abgezogen. Anstatt eines Cupolofens kann auch ein Ringofen angewendet werden. Die abgezogene Masse, welche auch noch Ba-

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riumcarbonat und Aetzbaryt enthält, wird zur Entfernung des letzteren zunächst mit Wasser ausgelaugt und dann mit Kohlensäure und Wasser behandelt. Die Masse wird vorher mit wenig Wasser angerieben; die Kohlensäure-Einwirkung findet in einem Gefässe statt, welches gut abgekühlt werden kann. Hierbei dürfen keine oxydirbare und reducirbare Stoffe, wie Eisenoxyd, zugegen sein. Man wendet deshalb den gefällten kohlensauren Baryt wiederholt an. Die Lösung von Wasserstoffsuperoxyd dient zur Bereitung der anderen Peroxyde, indem dieselbe z. B. mit Kalkmilch oder Kalkwasser zusammengebracht wird. Das sehr unlösliche Calciumsuperoxydhydrat wird abfiltrirt und kommt in feuchtem Zustande in den Handel; es soll dem Chlorkalk Concurrenz machen.

F. J. Bolton in London giebt folgendes Verfahren zur Darstellung von Aetzstrontian und Strontiumcarbonat aus Coelestin an. (Engl. P. 2708 vom 9. Juni 1882; D. P. 21588 vom 20. Juni 1882.) Der Coelestin wird wie gewöhnlich reducirt. Beim Auslaugen mit heissem Wasser geht das Sulfid teilweise in Aetzstrontian und Polysulfid über. Ersteres krystallisirt beim Abkühlen der heissen Lösung aus. Die von den Krystallen getrennte Lösung wird mit Kohlensäure behandelt. Um den noch in Lösung befindlichen Strontian zu gewinnen, lässt man von dem gefällten Carbonat die Lösung in ein Gefäss fliessen, wo sie mit Ammoniumcarbonat oder Kohlensäure und Ammoniak in Berührung kommt. Aus den entstandenen Ammoniumsulfiden wird durch Destillation mit Kalk das Ammoniak wiedergewonnen. Wenn kein Aetzstrontian gewonnen werden soll, so behandelt man das gepulverte Sulfat angefeuchtet mit Kohlensäure und Ammoniak, oder man behandelt das Reductionsproduct ebenso.

Das Ammoniak- und Kohlensäuregas resp. das Ammoniumcarbonat in Dampfform entnimmt man zweckmässig Hochofengasen, Gasen von Coksöfen etc.

Barium- und Strontiumcarbonat wird aus Schwerspath bezw. Coelestin nach Karl Lieber in Kaiserslautern (D. P. 22364 vom 8. August 1882) folgendermaassen dargestellt: Schwerspath bezw. Coelestin werden fein gemahlen, mit 1 Aequiv. Chlorcalcium, 4 Aequiv. Kohle und $^1/_2$ Aequiv. Eisen, in Form von Eisendrehspänen, gemischt und in einem Flammenofen, besser Revolverofen, geschmolzen. Die Schmelze wird ausgelaugt und die Laugen der Chloride werden von den noch darin enthaltenen sehr geringen Mengen an Schwefelverbindungen durch eingeblasene Luft vollständig befreit. Man leitet dann Ammoniak und Kohlensäure bis zum vollständigen Ausscheiden der kohlensauren Erden hindurch. Das Ammoniak erhält man aus den resultirenden Salkmiaklaugen mittelst Aetzkalks.

Es kann die Umwandlung der betreffenden Chloride in Carbonate auch durch Aetzkalk und Kohlensäure oder durch sehr fein zerteilten kohlensauren Kalk geschehen.

Jul. Lohsse in Gruna bei Dresden. Verfahren zur Herstellung von

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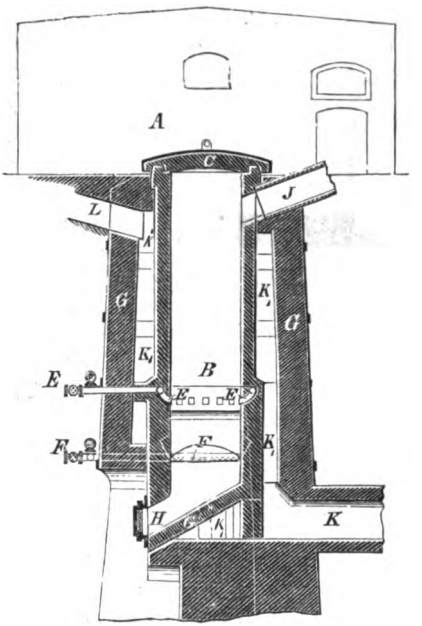
Strontiumoxyd durch Glühen von Coelestin mit Baryumoxyd. (D. P. 21156 vom 16. Mai 1882.) 150 Tle. aus Witherit dargestellter roher Baryt werden mit 200 Tln. gemahlenem Coelestin (etwas mehr als theoretisch erforderlich) und Wasser innig gemischt, getrocknet und geglüht. Die Masse wird ausgelaugt und die Lauge eingedampft.

Romuald Ziomczynski in Sudenburg-Magdeburg. Verfahren und Apparate zur Herstellung von Aetzstrontian und Aetzbaryt aus den schwefelsauren Salzen. (D. P. 20276 vom 21. Februar 1882.) Die Sulfate werden mit Kohle reducirt. Die noch glühenden Sulfide werden dann der Einwirkung von stark überhitztem Wasserdampf ausgesetzt. Dies geschieht in einem folgendermaassen eingerichteten Ofen.

Fig. 53.



A ist der Calcinirofen, *B* ein Schachtofen, welcher bei *C* mittelst eines ausgefütterten Deckels hermetisch verschlossen werden kann. Durch den Canal *K* und die Circulationscanäle K_1 werden Sohle und Mantel des Ofens *B* mit Feuergasen erhitzt, welche entweder speciell dafür auf einem Roste etc. erzeugt oder von irgend einer anderen Feuerung entnommen werden und bei *L* nach dem Schornstein entweichen.

Nachdem durch Einleiten von Wasserdampf durch das Rohr *F* die Luft aus dem Ofen getrieben ist, wird der Deckel *C* geöffnet und die Reductionsmasse eingefüllt. Nach Schliessen des Deckels wird erst durch das durchlöcherte Rohr *F*, dann durch den mit Verteilungsöffnungen versehenen Ringcanal *E* stark überhitzter Wasserdampf (von 500 bis 600° C.) eingelassen. Es entweicht der Schwefel als Schwefelwasserstoff durch den Abzug *J*. Das Aetzerdalkali wird durch die von der Feuerung entwickelten Wärme geschmolzen und fällt in zähflüssigem Zustand auf die Sohle *G*, von wo es durch *H* abgezogen wird. Wenn man dem Ofen *B* eine genügend hohe, die Rotglut übersteigende Temperatur geben kann, so kann auch die Reduction der Sulfate in dem oberen Teil dieses Schachtofens ausgeführt werden.

Nach Bela Lach in Wien wird bei der Reduction von Schwerspath (und anderen Erdalkalisulfaten) mit Kohle Salzsäuregas über die glühende Masse geleitet, so dass man gleich Chlorbarium und Schwefel-

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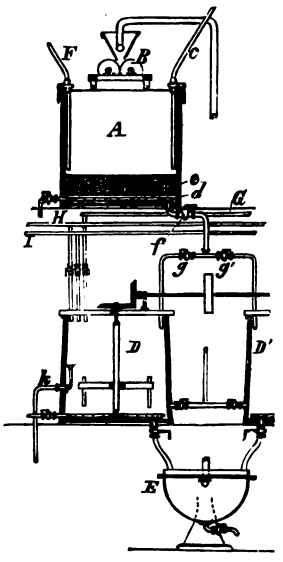
wasserstoff erhält. Die Aufschliessung soll eine vollständigere und die Aufschliessungstemperatur eine niedrigere sein, als bisher. (D. P. 19188 vom 20. December 1881.)

David Sidersky und Hermann Probst in Rositz (der Zuckerfabrik, welche zuerst das Scheibler'sche Strontianverfahren zur Gewinnung des Melassezuckers eingeführt hat) haben folgenden Apparat zur Darstellung von Strontiumcarbonat aus den Rückständen der Strontianitverarbeitung bei der Zuckergewinnung construirt. (D. P. 22140 vom 30. Juli 1882.) Um denjenigen Teil Strontian, welcher sich durch weiteres Auslaugen aus dem gebrannten Strontianit nicht entfernen lässt, in Form von Strontiumcarbonat zu gewinnen, wird der restirende Schlamm zwischen den Zerkleinerungswalzen *B* hindurch in das Gefäss *A* geleitet und dort einige Minuten mit Salzsäure (im Ueberschuss), welche aus einem Gefäss durch Rohr *c* zugelassen wird, vermittelst der Dampfschlange *d* gekocht. Enthält der Schlamm beträchtliche Mengen Eisen, so wird dasselbe durch Ammoniak, durch *F* kommend, ausgefällt. Andernfalls gelangt die stark saure Lösung des gesamten Strontians durch das Kiesfilter *e*, je nach der Stellung der Hähne *g* und *g'*, nach Bottich *D* oder *D'*. In diesen mit Rührwerken versehenen und durch Dampfschlangen geheizten Gefässen wird zunächst durch Schwefelsäure, die durch Rohr *G* eintritt, der Strontian als Strontiumsulfat ausgefällt. Nach Entfernung der Lauge durch Heberohr *k*, wird das Strontiumsulfat entweder, um gebildeten Gyps zu entfernen, mit Ammoniumsulfatlösung aus Gefäss und Rohr *I* oder nur mit Wasser gewaschen und dann durch Kochen mit Soda- oder Potaschelösung oder Schlempekohlenauszug, welche durch *H* zugeführt werden, in Strontiumcarbonat übergeführt, welches auf der Nutsche *E* von der Natrium- resp. Kaliumsulfatlösung getrennt und gewonnen wird.

Fig. 54.



Ein Apparat zum Krystallisiren von Strontianhydrat und ähnlichen Substanzen aus Lösungen von Eduard Theisen in Leipzig, D. P. 19186 vom 6. December 1881, hat drehbare Flächen. Auf diesen rieseln die Lösungen entlang, aus welchen die Ausscheidung mittelst Abkühlung erfolgen soll. Die Flächen werden von unten durch Circulation kalter Luft oder Kühlwassers abgekühlt: sie können von glatter Form oder zur Vermehrung der Kühlfläche von unebener (gewellter u. s. w.) Form sein. Sobald sich aus der über sie hinrieselnden Lösung eine Schicht Krystalle ausgeschieden hat, wird der Apparat gedreht, um neue Flächen in die geeignete Stellung zur

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Berieselung zu bringen, während die bereits bedeckten Flächen durch Abschaben von ihrer Krystallschicht befreit werden.

In den Lagern der beiden Böcke *w w* (Fig. 55 zeigt die eine Hälfte des Apparats) ruht eine schräg gestellte hohle Welle *b*, von deren Peripherie die Körper *x* flügelartig abstehen; diese Körper können aus geraden Flächen, aus gewellten Flächen oder aus Röhren bestehen, welche die Einführung eines Kühlmittels zu dem angegebenen Zweck gestatten. Die Einführung desselben erfolgt durch eine in der hohlen Welle *b* steckende zweite hohle Welle *a*, deren Oeffnungen mit den Zwischenräumen in den Körpern *x* communiciren. Der Eintritt des Kühlmittels erfolgt an dem dem Zulauf der Lösung entgegengesetzten Ende des Apparates, so dass ein Gegenstrom stattfindet. An dem höheren Ende der Kühlflächen sind Rinnen angebracht, in welche sich aus den Hähnen *h h* die Lösung ergiesst, welche von diesen Rinnen aus sich über zwei geneigte Flächen des Apparates verbreiten. Während ihres Laufes scheiden sich aus dieser Lösung durch Einwirkung der Abkühlung die Krystalle aus und bleiben an den Flächen hängen. Sind die Flächen teilweise oder ganz mit Krystallen bedeckt, so kann der Apparat so gedreht werden, dass entweder die entgegengesetzten Flächen der Körper *x x* in die geeignete Lage zur Berieselung kommen oder auch die Flächen der bisher in senkrechter Stellung befindlichen Körper. Die anhaftenden Krystalle werden auf geeignete Weise von ihren Flächen gelöst und entfernt. Ein Gefäss *v* unter dem Apparat fängt alle ablaufende Lösung auf. Die Küken der Hähne *h* können mit der Welle *b* derartig in Verbindung gesetzt werden, dass die Hähne bei beginnender Drehung sich schliessen und erst bei vollendeter Drehung sich wiederum öffnen, um ein Auslaufen der Lösung während der Drehung zu verhindern. Bei einer Modification sind die Kühlflächen nicht in Kreuzform angeordnet, sondern an die Peripherie einer um ihre Axe drehbaren Trommel verlegt.

Fig. 55.

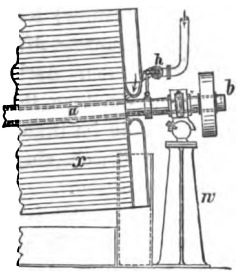
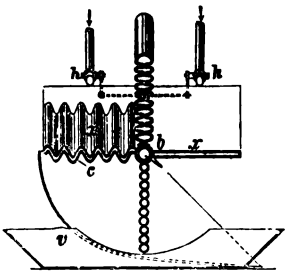


Fig. 56.



II. Kalk.

Erdmann Arnold in Fürstenwalde hat einen Kammerofen zum Brennen von Kalk angegeben. (D. P. 17742 vom 26. Juni 1881.) Der Ofen hat vier um Schornstein *F* angeordnete Kammern (Fig. 57).

Unter der Sohle jeder Kammer liegt eine Wärmekammer *M*, welche entweder von durchbrochenen Wänden durchzogen oder mit Steinen ausgesetzt ist, und einerseits in den Aschenfall der über ihr liegenden Kammer

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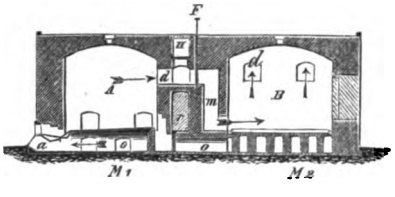
mündet, andererseits durch Canäle *o* mit der vorhergehenden Kammer verbunden ist. Ausser der so hergestellten Verbindung der Kammer mit der im Betriebe vorhergehenden Kammer ist die Kammer durch Canäle *m d* mit der nachfolgenden Kammer direct verbunden; von Canal *d* zweigt sich je ein nach dem Schornstein führender Canal *H* ab. Der Betrieb erfolgt in der Art, dass die Verbrennungsluft durch die vorhergehende (abgebrannte) Kammer und die Wärmekammer M_1 in den vorn geschlossenen Aschenfall unter den geknickten Rost *a* geleitet wird, und die Feuergase nach Durchströmen durch die im Brande befindliche Kammer *A* in die Canäle *dm* und in die folgende (frisch eingesetzte) Kammer *B* und von hier durch *d* in den Schornstein gelangen.

Fig. 57.



Wenn die vorhergehende Kammer abgekühlt ist, so wird dieselbe sofort ausgekarrt, wobei die Luft immer noch durch sie zugeleitet wird; es erfolgt jetzt das Vorwärmen der Luft durch die in der Wärmekammer M_1 aufgespeicherte Wärme.

Nach der Erfindung von Charles Sebastian Smith in Leicester und Thomas Moore in Shipley werden Kalkpatronen zum Sprengen von Gestein benutzt. (D. P. 19150 vom 2. November 1881.) Nachdem die mit einem Längscanal versehene Kalkpatrone in das Bohrloch eingesetzt worden ist, wird eine durchlöcherte Röhre, welche einen Hahn trägt, eingeschoben. Nach dem Besetzen wird in die Röhre Wasser gepumpt und der Hahn sodann geschlossen. Um zu verhindern, dass der Kalk in die Wasserröhre eintrete, umgiebt man dieselbe mit einem gewebten Schlauche.

Société anonyme de Certaldo in Paris. Neuerungen in dem Verfahren zum Härten und Färben von Gyps, Alabaster etc. (D. P. 22289 vom 2. August 1881.) Die aus Rohgyps geschnittenen Gegenstände werden getrocknet und dann gehärtet, indem man sie in ein Bad taucht, dem man neben dem früher angewendeten Alaun noch Oxalsäure oder auch oxalsaure Salze hinzugesetzt hat. Die gehärteten Gegenstände werden wiederum getrocknet und dann in die Färbeflüssigkeit getaucht. Die angewendete Härtungsflüssigkeit gestattet auch, die Färbung mit der Härtung zu vereinigen, indem man dem ersten Bade den Farbstoff, Fuchsin etc., beimischt.

Vereinigte chemische Fabriken Actiln-Gesellschaft in Leopoldshall. Darstellung von Calciumoxychlorid, Reinigung von Kalk und Anwendung des Calciumoxychlorids für Gewinnung von Magnesiumhydroxyd aus Chlormagnesiumlösung. (D. P. 20277 vom 25. Februar 1882.) Gebrannter Kalk wird in der Chlorcalciumlösung von 1·12 bis 1·15 Vol.-Gew., wie sie bei der Darstellung von Magnesiumhydroxyd aus Chlormagnesiumlösung und Aetzkalk gewonnen wird, gelöscht. Dabei bildet sich eine Lösung von Calciumoxychlorid ($3CaO \cdot CaCl^2 + 16H^2O$) in Chlor-

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calciumlauge, ferner ein Kalkbrei, welcher mit den an Thon und Eisenoxyd reichen grösseren Kalkstücken gemischt ist. Nach Abziehen der Lösung wird dieser Brei mit frischer Chlorcalciumlauge geschlämmt, um Kalkbrei in möglichst reinem Zustande zu erhalten.

Die Calciumoxychloridlösung dient wiederholt zum Löschen von gebranntem Kalk, bis sie ein Vol.-Gew. von 1·3 zeigt. Dann wird ein Teil derselben mit den Chlormagnesiumlaugen aus der Chlorkaliumfabrikation (welche annähernd dieselbe Concentration zeigen) vermischt. Dabei zersetzt sich das Calciumoxychlorid, der frei werdende Kalk fällt das in der Chlormagnesiumlösung vorhandene Eisenoyyd, das Chlorcalcium fällt die Schwefelsäure als Gyps. Die so gereinigte Chlormagnesiumlauge wird nun mit der Hauptmenge der Calciumoxychloridlösung vermischt, wobei sich reines Magnesiumhydroxyd ausscheidet. Man kann das Calciumoxychlorid auch erst zur Krystallisation bringen und dann zur Fällung gereinigter Chlormagnesiumlauge benutzen.

III. Magnesia.

Ramdohr, Blumenthal & Co. in Halle a. S. geben ein Verfahren zur Gewinnung von Magnesia und Salzsäure aus Chlormagnesium an. (D. P. 19259 vom 6. September 1881.) Die Lösungen von Chlormagnesium werden, nachdem dieselben auf bekannte Weise von fremden Salzen gereinigt sind, in passenden Gefässen auf ca. 40 bis 45° B. eingedampft, so dass die Lösung im wesentlichen $MgCl^2 + 6H^2O$ enthält. Dieses so erhaltene Chlormagnesium wird unter Zusatz von 4 bis 10 Proc. gemahlenem Magnesit oder künstlich dargestellter kohlensauerer Magnesia unter Ueberleitung von atmosphärischer Luft oder freiem Sauerstoff in Flammöfen mit überschlagender Flamme, oder in Muffelöfen oder auch in Oefen mit Unterfeuer längere Zeit zur Rotglut erhitzt, bis die Entwickelung von Chlorwasserstoff aufhört. Die bei dem Process entweichende Salzsäure wird in bekannter Weise condensirt. Es bleibt ein mehr oder weniger chlorhaltiges Magnesiumoxychlorid zurück, welches mit Wasser unter Druck gekocht oder durch gespannte Wasserdämpfe erhitzt wird und sich dabei in Magnesia und Chlormagnesium zerlegt. Jene wird durch Filtriren oder Centrifugiren von der Lauge getrennt. — Der Magnesit kann bei diesem Verfahren durch das Carbonat einer andern alkalischen Erde ersetzt werden.

Thomas Twynam in London. Fabrikation von Magnesia. (Engl. P. 4397 vom 10. October 1881.) In dem Weldon-Process soll die Manganchlorürlauge nicht durch Kalk, sondern durch gebrannten Dolomit zersetzt werden. Von diesem wird soviel genommen, dass der Kalkgehalt zur Bildung des Calciummanganits ausreicht. Die Operation wird in den gewöhnlichen Oxydisern ausgeführt. Nach der Oxydation wird nicht allein so viel Manganchlorür zugesetzt, dass der Kalk aus der Verbindung von Mangansuperoxyd und Kalk in Chlorcalcium umgewandelt wird, sondern so niel, dass auch die vorhandene Magnesia zu Chlormagnesium wird. Das ausgeschiedene

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Manganoxydul wird dann durch Lufteinblasen höher oxydirt. Die vollkommene Oxydation wird aber nur durch Zusatz von Kalkmilch erreicht, so dass die Mangan-Kalkverbindung wieder entstehen kann. Vor dem ersten Zusatz der Chlormanganlösung lässt man möglichst viel Chlorcalciumlösung abfliessen. Aus der Lösung, welche, von dem regenerirten Braunstein getrennt, Chlorcalcium und Chlormagnesium enthält, wird durch Kalk Magnesia gefällt.

Der Erfinder will auch so verfahren, dass die Manganlauge erst durch Magnesiahydrat gefällt wird und dass dann Kalkmilch zugesetzt wird, um in dem Oxydiser die Mangan-Kalkverbindung zu bilden. Weiter wird wie vorhin verfahren. Die vom Manganschlamm getrennte Flüssigkeit enthält dann hauptsächlich Chlormagnesium.

Ferner soll Magnesia bereitet werden, indem Dolomit mit rohem Holzessig digerirt wird, wobei nur der Kalk in Lösung gehen soll. Die Calciumacetatlösung wird mit Magnesiumsulfat gefällt. Aus der Magnesiumacetatlösung wird durch Kalk oder Dolomit Magnesia gefällt und wieder essigsaurer Kalk hergestellt. Das Magnesiumsulfat soll durch Digestion von Dolomit mit Calciumsulfat erhalten werden. — Auch Eisenchloridlösung, die beim Fällen von Kupfer als Abfall resultirt, soll mit Dolomit gefällt werden, und durch darauffolgende Digestion der Lösung mit Dolomit Magnesia gewonnen werden. — In der Kaliumchloratfabrikation soll der Kalk ebenfalls durch Dolomit ersetzt werden. Nachdem das Product der Einwirkung von Chlor auf Dolomit durch Chlorkalium zersetzt ist, wird die Mutterlauge vom Chlorat eingedampft, bis Chlorkalium-Chlormagnesium auskrystallisirt. Auf diese Weise wird der Verlust an Chlorkalium verringert, da das Doppelchlorid an Stelle von Chlorkalium gebraucht werden kann. Aus den schliesslichen Mutterlaugen wird die Magnesia durch Kalk gefällt.

Adrien Lanquetin in Paris. Fabrikation von Magnesia und Zinnsalzen. (Engl. P. 3844 vom 3. September 1881; D. P. 20396.) Es wird die schon wiederholt angegebene Zersetzung zwischen Magnesiumcarbonat (Magnesit, Dolomit) und Chlorcalcium*) beschrieben und als neu beansprucht. Ferner sollen bei Ersatz des Chlorcalciums durch Calciumsulfat oder -phosphat die entsprechenden Magnesiumsalze erhalten und der Dolomit etc. soll durch Zinkoxyd oder -carbonat ersetzt werden können. Der Dolomit soll so gebrannt werden, dass nur das Magnesiumcarbonat seine Kohlensäure verliert, und dann wieder mit Kohlensäure behandelt werden, oder die gesamte Kohlensäure des Dolomits wird ausgetrieben, das Material wird durch Löschen mit Wasser zerteilt, und während der Reaction mit Chlorcalcium wird Kohlensäure eingeleitet. Wird Chlormagnesium und kohlensaurer Kalk unter Druck auf 150 bis 200° erhitzt, so findet nach dem Erfinder die umgekehrte Reaction statt, und man soll auf diese Weise reine kohlensaure und weiter gebrannte Magnesia erhalten.

In einem anderen Patent (Engl. P. 3846 vom 3. September 1881) desselben Erfinders wird die Bildung von Soda durch Einwirkung von Kohlen-

*) Vgl. z. B. Twynam, Engl. P. 1019/1880, Techn.-chem. Jahrb. 1882 S. 142.

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säure auf ein Gemisch von Kochsalzlösung und Dolomit (anstatt Magnesia) beansprucht.*) Es soll so viel (gebrannter) Dolomit angewendet werden, dass das Magnesiumcarbonat überschüssig vorhanden ist. Aus dem Gemisch von Natriumbicarbonat und kohlensaurem Kalk wird nach der Calcination die Soda ausgewaschen. Die Chlormagnesiumlösung enthält bei Anwendung eines Ueberschusses von Dolomit kein Chlorcalcium. Anstatt Dolomit soll auch Zinkspath angewendet werden.**)

Bereitung von Magnesia zur Abscheidung des Ammoniaks aus Excrementen, Sielwassern u. s. w. Von Theophil Schloesing in Paris. (Engl. P. 1820 vom 27. April 1881; D. P. 18976 vom 24. August 1881.) Da die grosse Verdünnung der Cloakenwässer eine Destillation zur Gewinnung des Ammoniaks nicht rentabel macht, so soll dasselbe als Ammoniummagnesiumphosphat niedergeschlagen werden; aber nicht, wie bisher, mit Hilfe eines (zu kostspieligen) löslichen Phosphats und eines Magnesiumsalzes, sondern von freier Phosphorsäure und Magnesia.

Zur Fällung der Magnesia aus ihren Lösungen, auch aus Seewasser, dient gelöschter Kalk in kleinen Fragmenten von genügender Porosität, welchen in systematischer Weise die Magnesialösung begegnet. Die Bruchstücke werden zweckmässig aus Kalkhydrat und gebranntem Dolomit hergestellt. Allmälig wird der Kalk dieser Stücke vollständig durch Magnesia ersetzt. Bei Gegenwart von Sulfaten in der Magnesialösung werden diese erst durch ein Kalksalz gefällt. Um das Ammoniak aus den Abwässern zu fällen, werden aus diesen die festen Stoffe erst abgeschieden, oder sie werden bei dem Ammoniummagnesiumphosphat belassen. Da der voluminöse Niederschlag aus schwachen Magnesialösungen, wie Seewasser, kaum zu filtriren ist, so wird die Magnesia als basisches Phosphat gefällt, welches sich leicht absetzt. Letzteres dient dann zur Fällung der ammoniakalischen Flüssigkeit.

Die Lösung der Phosphorsäure wird durch Behandlung von Knochen oder mineralischen Phosphaten mit Schwefelsäure erhalten. Sind letztere pulverförmig vorhanden, so werden sie erst mit concentrirter Schwefelsäure in grössere, aber poröse Massen gebracht, die dann mit verdünnter Schwefelsäure behandelt werden, und zwar auch in systematischer Weise. (S. Techn.-chem. Jahrb. 1883 S. 304.)

Adolf Wünsche in Hamburg stellt Magnesia oder Magnesiumcarbonat aus Ammonium-Magnesiumcarbonat her (D. P. 18722 vom 29. Juli 1881). Die Lösung eines Magnesiumsalzes, z. B. die Endlauge der Kalisalzfabriken ($MgCl^2$) wird mit Salmiak und Ammoniak versetzt, und dann wird Kohlensäure eingeleitet. Das Ammoniummagnesiumcarbonat scheidet sich in verhältnismässig grossen Krystallen ab und nicht fein verteilt wie bei der Fällung mit Ammoncarbonatlösung. Der Niederschlag wird abfiltrirt, durch Decken gereinigt und mit Magnesia vermischt.

$$Mg(NH^4)^2(CO^3)^2 + MgO = 2MgCO^3 + 2NH^3 + H^2O.$$

*) Vgl. Engel's Verf., D. P. 15218, im Techn.-chem. Jahrb. 1882 S. 131.

**) Vgl. Wittgen und Ehler im Techn.-chem. Jahrb. 1883 S. 63.

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Die Ammoniakentwickelung beginnt schon in der Kälte. Wolman das Doppelsalz nur durch Wärme zersetzen, so würde man Ammoncarbonat erhalten, das zur Fällung des Magnesiumsalzes dann nicht so geeignet ist wie das obige Verfahren. Das Ammoniak und die durch Glühen des Magnesiumcarbonats erhaltene Kohlensäure werden einzeln zur Zersetzung einer neuen Portion Magnesiumsalz verwendet.

Fabrikation von Magnesiacement. Von E. A. Sorel in Paris. Engl. P. 2662 vom 18. Juni 1881. Es sind verschiedene Verfahren angegeben um Cement zu bereiten, die darauf hinauskommen, dass entweder Magnesia mit krystallisirtem Magnesiumsulfat gemischt und dann mit Wasser befeuchtet wird, oder dass Magnesia mit einer Lösung von Magnesiumsulfat gemischt wird.

Oscar Schreiber in Berlin und F. Schwarzer in Barby stellen Stereotypplatten, Clichés etc. aus Magnesia-Holz-Pasta her (D. P. 18777 vom 25. November 1881). Zur Herstellung der Pasta verwendet man für 100 Gewichtsteile fertiger Masse 30 Tle. Magnesia, 60 Tle. Chlormagnesium von 33° B. und 10 Tle. Holzpulver. Diese Bestandteile werden mit einander gemischt, der erhaltene Brei wird in die Gussformen gegossen und einer Temperatur von 60—80° C. ausgesetzt.

Stephen Cliff in Leeds (Engl. P. 1896 vom 2. Mai 1881) meint, er könne die Bestandteile des geglühten Dolomits von einander trennen, indem er denselben mit Schwefelsäure, oder einem Sulfat, oder einem Sulfid behandele, wobei denn die Magnesia infolge ihres grösseren specifischen Gewichts früher niederfallen soll, als das Calciumsulfat.

XV. Alaun.

James Webster in Solihull, Warwick, hat ein Verfahren zur Herstellung von Thonerde angegeben, die besonders geeignet für die Aluminiumfabrikation sein soll. (Engl. P. 2580 vom 14. Juni 1881. D. P. 18721.) Ein Gemisch von Alaun mit $^1/_3$ Gaspech wird in einem Sodaofen auf etwa 250° erhitzt, bis alles Krystallwasser entwichen ist. Nach dem Erkalten und Zerkleinern wird die Masse mit einem Gemisch von 1 Raumteil Salzsäure und 5 Wasser behandelt. Die Masse wird zu Haufen aufgeworfen. Wenn sich kein Schwefelwasserstoff mehr entwickelt, werden 5 Proc. Kohle zugemischt und die Masse dann mit Wasser zu einem dicken Brei zermahlen. Aus diesem werden Stücke geformt, die durch allmäliges Erhitzen bis auf 150° getrocknet werden. Die Stücke werden dann in einer verticalen Retorte erhitzt, in welche ein Strom von 2 Vol. Dampf und 1 Vol. Luft injicirt wird. Dadurch soll Schwefel, Eisenoxydsulfat und Salzsäure überdestillirt werden. Die calcinirte Masse wird mit Wasser ausgekocht; die Lösung auf Kaliumsulfat eingedampft und Thonerde bleibt zurück.

Die Lauge von dem Einwirkungsproduct der Schwefelsäure auf Bauxit u. dgl. enthält gewisse Mengen freier Säuren, welche die Verwendung solcher

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felsaurer Thonerde bei Ultramarin, Azofarbstoffen, in der Papierfabrikation u. s. w. ausschliessen. F. Lienau in Uerdingen a. Rh. (D. P. 21346 vom 23. Juni 1882) sättigt die freie Säure durch Magnesia.

Nach dem D. P. 23493 vom 24. August 1882 desselben Erfinders soll das in der rohen schwefelsauren Thonerde enthaltene Eisenoxyd in Oxydul übergeführt werden, in welchem Zustande es für die Darstellung selbst der feinsten Schreibpapiere vollkommen unschädlich sein soll. Das Eisenoxydulsulfat bildet nämlich mit der schwefelsauren Magnesia, welche durch die vorhin angegebene Neutralisirungsmethode entstanden ist, ein fast farbloses Doppelsalz, welches wie das analog zusammengesetzte schwefelsaure Eisenoxydulammoniak sich an der Luft nicht oxydirt. Um das Eisenoxyd zu reduciren, kann man sämtliche Reductionsmittel, wie schweflige Säure und ihre Salze, Zink, Schwefelnatrium und Schwefelcalcium etc., in der Weise benutzen, dass man dieselben in Rohlauge einträgt und mit derselben vermischt, bis die Rohlauge durch Rhondakalium nicht mehr gefärbt wird. Am besten eignet sich Schwefelwasserstoff, da teils schon kleine Mengen desselben grössere Mengen Eisenoxyd reduciren, teils keine fremden Körper in die Lauge und damit in die Waare gelangen. In der Ausführung wird Lauge oder Wasser auf einen Coksturm gebracht, wobei die Anwendung von Elevatoren oder Pulsometern wegen der Erwärmung der Flüssigkeit ausgeschlossen ist. Während die Flüssigkeit langsam hinabrieselt, streicht von unten her ein kräftiger Strom Schwefelwasserstoff, welcher zunächst das in der Lauge enthaltene Eisenoxyd reducirt und darauf von derselben gelöst wird. Die Flüssigkeit läuft nun durch eine hölzerne Rinne zu einer grösseren, in einem gemauerten Bassin befindlichen Menge Lauge; sie wird mit dieser vermischt, bis Rhodankalium keine rote Färbung mehr hervorruft. Alsdann wird die Lauge geklärt, indem man sie entweder durch Filterpressen schickt, oder, was sich wegen der geringen Menge des ausgeschiedenen Schwefels besonders empfiehlt, indem man sie durch Filzhüte laufen lässt. Man erhält so eine farblose, klare Lauge, welche beim Eindampfen eine blendend weisse Waare liefert. Dieselbe färbt sich, was für die Papierfabrikation wesentlich ist, des oben erwähnten Eisenoxyduldoppelsalzes wegen selbst bei längerem Liegen an der Luft nicht gelb, sondern behält die weisse Farbe unverändert bei.

Nach Will. Gentles in Widnes wird zur Fabrikation von eisenfreier schwefelsaurer Thonerde (Engl. P. 732 vom 15. Februar 1882) der Lösung des rohen Thonerdesulfats eine Milch von so viel Chlorkalk zugesetzt, dass alle freie und an Eisen gebundene Schwefelsäure gefällt und das Eisen in Chlorid umgewandelt wird. Nach der Entfernung von dem Niederschlage wird die Lösung eingedampft, bis sie beim Erkalten erstarrt. Aus dieser Masse wird durch Pressen das leicht lösliche Eisenchlorid entfernt. Der flüssige Teil wird dann auch zur Trockne gebracht.

C. Semper in Philadelphia setzt nach dem Engl. P. 2997 vom 7. Juli 1881 zur Entfernung des Eisens aus eisenhaltiger Aluminiumsulfat-Lösung neben Blutlaugensalz auch Kupfersulfat zu.

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A. A. Croll in London (Engl. P. 1731 vom 21. April 1881) giebt an, die Darstellung von Aluminiumsulfat werde erleichtert, wenn man die Masse in der concentrirten Form, wie sie nach dem Engl. P. 2884/1877 durch Einwirkung heisser Schwefelsäure auf leicht gebrannten Thon erhalten wird, durch Wasser oder Dampf verdünnt.

Eisenfreie schwefelsaure Thonerde erzeugt Josiah Wyckliffe Kynaston in Liverpool (D. P. 21526 vom 31. August 1882) folgendermaassen. Die durch Behandlung von Bauxit mit heisser Schwefelsäure gewonnene Lauge wird von dem Rückstand getrennt und neutralisirt. Alsdann wird, um das Eisen, welches als Oxyd vorhanden sein muss, auszuscheiden, der Lösung frisch gefälltes, noch feuchtes Mangansuperoxyd zugesetzt, welches vorher mit verdünnter Schwefelsäure gewaschen ist, oder das Mangansuperoxyd wird in der Thonerdelösung durch Zusatz eines Mangansalzes und eines oxydirenden Reagens erzeugt. Das Mangansuperoxyd schlägt das Eisen nieder. War jedoch ein Mangan- oder ein Eisenoxydulsalz in der Lösung vorhanden, oder war die Lösung nicht ganz neutral, so löst sich ein Teil des Mangans. Die Thonerdelösung wird vom Mangan- und Eisenniederschlag abgezogen, und sollte Mangan darin aufgelöst sein, so wird die Lösung mit einem geringen Ueberschuss Chlorkalklösung behandelt; nach 24 bis 48 Stunden scheidet sich das Mangan als Superoxyd aus, welches zur Ausscheidung des Eisens aus einer neuen Quantität Thonerdelösung verwendet werden kann. Die nunmehr gereinigte Lösung bedarf nur noch der Concentrirung, um eisenfreies Thonerdesulfat zu liefern.

Aus dem (Gesamt-) Niederschlag von Eisen und Mangan wird das Eisen mit verdünnter Säure, namentlich Schwefelsäure, ausgezogen, das restirende Mangansuperoxyd mit Wasser gewaschen und von neuem zum Ausfällen von Eisen verwendet.

P. Spence und J. M. Spence in Manchester (Engl. P. 5650 vom 24. December 1881) suchen Natronalaun in krystallisirtem und möglichst reinem Zustande darzustellen. Eine möglichst neutrale und eisenfreie Lösung von Thonerdesulfat wird mit der entsprechenden Menge Natriumsulfat versetzt. Die Lösung wird durch Wasserzusatz auf 50° Tw. (1·25 Vol.-Gew.) beim Siedepunkt gebracht. Beim Abkühlen setzt sich nur wenig Alaun ab. Die Lösung wird weiter bis zu 110° Tw. (1·55 Vol.-Gew.) eingedampft. Diese Lösung wird in kalte Alaunlösung von der vorigen Concentration laufen gelassen, bis bei beständigem Umrühren die Temperatur von etwa 17° erreicht ist. Dann bildet sich nicht ein dichtes Magma, sondern eine gute Krystallisation. Die Mutterlauge wird wieder mit der heissen dichten Lösung versetzt, bis 17° Temp. erreicht wird. Da die Menge der Mutterlauge immer zunimmt, so wird von Zeit zu Zeit ein Teil davon entfernt, und diese Lösung wird wegen ihres Thonerdesulfatgehalts zur Darstellung von Kalialaun benutzt.

Thadée Gladysz in Marseille giebt ein Verfahren zur Herstellung von krystallisirtem Chloraluminium an. (D. P. 21154 vom 2. Mai 1882.)

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Dasselbe beruht auf der Eigenschaft derartige Chloride in ihren wässerigen Lösungen concentrirt werden zu können, ohne die mindeste Zersetzung zu erleiden, vorausgesetzt, dass man die Verdampfung bei einem Druck vornimmt, der niedriger ist als der gewöhnliche Atmosphärendruck.

Man bedient sich vorteilhaft desjenigen Chloraluminiums, das durch Zersetzung von roher schwefelsaurer Thonerde durch das Chlorcalcium der Sodafabriken gewonnen wird. Der hierbei entstandene Gyps lässt sich leicht filtriren und auswaschen. Das flüssige Chloraluminium, welches noch mit dem Waschwasser vermengt ist, wird zunächst in offenen, verzinnten kupfernen Kesseln concentrirt; diese Concentration kann bis 25° oder 30° B. getrieben werden. Hierbei wird das geringe Quantum Gyps, das noch in Lösung war, gefällt und aus der Flüssigkeit entfernt.

Die 25° bis 30° B. zeigende Flüssigkeit wird nun in geschlossene, verzinnte kupferne Kessel gebracht und unter Erzeugung eines Vacuums weiter concentrirt. Es genügt, diese Operation bei 50 bis 55 cm Quecksilberhöhe vorzunehmen. Man kann nun die Masse bis zum Trocknen eindampfen oder aber die Operation unterbrechen und langsam einkrystallisiren lassen unter Erzielung einer Mutterlauge. Wendet man die letztere Methode an, so trennt man die Krystalle des Chlorhydrats von den Mutterlaugen durch Abtropfenlassen oder Centrifugiren. Das auf diese Weise erhaltene Chloraluminium kann nach demselben Verfahren gereinigt werden. Seine Zusammensetzung ist: lösliche Thonerde 21 Proc., Chlor 44 Proc.

Man kann auch in folgender Weise verfahren. Zunächst concentrirt man im Vacuum und dann sättigt man mittelst Chlorwasserstoff, um das verbleibende Chlorhydrat völlig zu fällen. Chloraluminium ist in salzsaurer Lösung schwer löslich.

Ist eine salzsaure Lösung von Thonerde, Eisenoxyd, Manganoxyd, Chlorcalcium gegeben, wobei die Thonerde vorherrschend ist, und lässt man in dieses Gemenge Chlorwasserstoffgas eintreten, so wird ein Moment kommen, wo das Chloraluminium beginnt, sich in vollkommen krystallisirtem Zustande abzusetzen. Die Krystallisation wird beendet oder doch nahezu beendet sein mit der vollkommenen Sättigung der Flüssigkeiten durch das Chlorwasserstoffgas.

Sättigt man demnach die Chloraluminium enthaltende Lösung, welche entweder von der Auflösung gelatinöser Thonerde in Salzsäure oder von der Doppelzersetzung von Alaunen oder Thonerdesulfaten durch Chlorcalcium, Chlorbarium etc. herrührt, durch Chlorwasserstoffgas, das auf beliebige Weise hergestellt werden kann, so erhält man als Resultat einesteils krystallisirtes Chlorhydrat, das, nachdem man es hat abdampfen und in einem trocknen Luftstrom trocknen lassen, vollständig neutral ist, anderenteils Mutterlauge, bestehend aus Salzsäure, welche alle die Thonerde begleitenden Unreinigkeiten enthält. Das auf diese Weise bereitete Präparat enthält ebenfalls 21 Proc. lösliche Thonerde und 44 Proc. Chlor.

Löwig in Breslau stellt kohlensaures Natriumaluminat und

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kohlensaures Kalium-Aluminat (D. P. 19784 vom 26. Febr. 1882) dar, Verbindungen, die für die Technik von Bedeutung zu werden versprechen. Während eine Lösung von Alkalialuminat durch Kohlensäure oder Alkalibicarbonat so zersetzt wird, dass Thonerdehydrat und einfach-Alkalicarbonat entsteht, tritt eine andere Reaction ein, wenn man in eine Lösung von Alkalibicarbonat Kohlensäure einströmen und gleichzeitig eine Lösung von Alkalialuminat zerfliessen lässt, so dass Kohlensäure stets im Ueberschuss vorhanden ist. Dann bildet sich eine unlösliche Verbindung von Kohlensäure mit Alkalialuminat, welche, bei 90° getrocknet, die Zusammensetzung K^2O, Al^2O^3, $2\,CO^3 + 5\,H^2O$ hat. Das Aetzalkali, welches nach der Gleichung K^2O, $Al^2O^3 + 2\,NaHCO^3 = K^2O$, Al^2O^3, $2\,CO^2 + 2\,NaHO$ entsteht, geht in der Kohlensäureatmosphäre gleich wieder in Bicarbonat über, dient also als Uebertrager der Kohlensäure. — Der Process kann continuirlich geführt werden. Die kohlensauren Alkalialuminate sind weisse kreideähnliche Massen, die sich in verdünnten Säuren wie einfach kohlensaure Salze lösen. Zur Darstellung der Kaliumverbindung kann man in eine Lösung von Kalium- oder Natriumcarbobinat entweder eine Lösung von Kalialuminat oder eine gemischte Lösung von Natronaluminat und Chlorkalium einfliessen lassen.

Ohne Mitwirkung von Kohlensäure kann man in eine Lösung von Alkalibicarbonat eine Lösung von Alkalialuminat bis zur vollständigen Zersetzung einfliessen lassen. Kalibicarbonat und Natronaluminat geben kohlensaures Kalialuminat, Natronbicarbonat liefert mit dem erwähnten Gemisch ebenfalls die Kaliumverbindung. Die auf diese Weise erhaltenen Verbindungen haben dieselbe Zusammensetzung wie die erst erwähnten, bilden aber nach dem Trocknen bei 70 bis 80° harte hornartige Massen, die im Wasser unter Knistern in kleine Stücke zerfallen und nicht gut auszuwaschen sind. Die kohlensauren Alkalialuminate eignen sich vortrefflich zur Herstellung reiner eisenfreier Thonerdebeizen, antiseptischer Lösungen u. s. w.

Adolf Tedesco in Mügeln bei Pirna stellt zunächst Bariumaluminat dar und führt dieses in Alkalialuminat über (D. P. 19767 vom 31. Januar 1882) ein Gemisch von feinem Schwerspathpulver, Thonerdehydrat oder Bauxit oder dgl. und Kohle oder Teer, Oel oder dgl. wird der Rotglut ausgesetzt. Das entstandene Bariumaluminat wird durch Wasser gelöst, und die Lösung wird durch Alkalisulfat zersetzt. Die vom schwefelsauren Baryt getrennte Lösung wird auf festes Aluminat oder auf Thonerdehydrat und Alcalicarbonat verarbeitet; das Bariumsulfat wird wieder in der Fabrikation benutzt.

XVI. Glas.

I. Schmelzen der Glasmasse.

Die Hafenöfen mit Gasfeuerung haben im vergangenen Jahre verschiedene Verbesserungen und Neuerungen erfahren.

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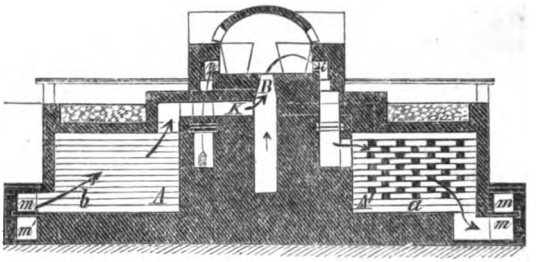
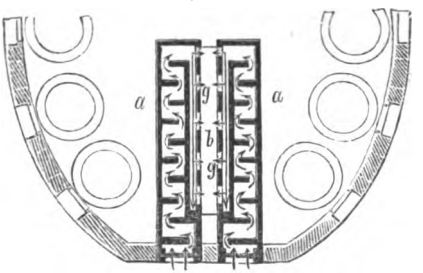
E. H. Siebert in Berlin richtet die Betriebsführung eines mit zwei ohne Umkehrung arbeitenden Regeneratoren versehenen Hafenofens folgendermaassen ein. Die beiden Regeneratoren *AA'* des Ofens haben zwei Arten von Zellen, von denen die Zellen *b* zur Lufterhitzung dienen, während die dazwischen angeordneten Zellen *a* von den Feuergasen durchstrichen werden. Das Gas strömt bei *B* in den Ofen, die Luft tritt bei *K* von links oder rechts ein. Die Flamme tritt in der Mitte ein und in den Aussenwänden zwischen den Arbeitshäfen bezw. Arbeitsöffnungen bei *i* oder *n* aus. *m* ist der Luftzuführungscanal, *m'* der Rauchcanal. Die Betriebsführung ist derartig, dass abwechselnd die Luft durch den einen Regenerator dem Feuer zugeleitet, die Feuergase aber durch den anderen Regenerator abgeleitet werden, was durch abwechselndes Ziehen von Schiebern erreicht wird. Ausserdem können aber die übereinander liegenden Rauch- und Luftcanäle verbunden werden, so dass die Luft aus dem einen Regenerator durch *a* und *b* bezw. *n* und *K* zuströmt. (D. P. 22087 vom 2. Mai 1882.)

Fig. 58.



E. F. W. Hirsch in Radeberg hat eine Vorrichtung zur Erhitzung der Feuerluft für Glashafenöfen angegeben. (D. P. 21109 vom 24. März 1882.) Die im Ofenraum erhitzten, während des Betriebes herausziehbaren Lufterhitzungsretorten *a* (Fig. 59) haben innen Einrichtungen zur Verlängerung des Weges der von aussen zuströmenden, eventuell vorgewärmten Luft in denselben. Sie sind zu beiden Seiten der Gasausströmungsschlitze auf der Hafenbank *b* angeordnet und haben innen und oben Ausströmungsöffnungen *g* für die in ihnen erwärmte, zur Verbrennung des Gases dienende Luft.

Fig. 59.



Bei dem von Karl Nehse in Blasewitz und F. Osc. Hirsch in Radeberg patentirten Verfahren zum continuirlichen Schmelzen und Ausarbeiten von Glas (D. P. 22089 vom 24. Mai 1882) hat der Schmelzhafen drei Abteilungen b_1 b_2 b_3, die durch Löcher am Boden mit einander communiciren und oben eine Schnauze *c* haben. Der Hafen *a* steht etwas zum doppelteiligen und hier vorn gedeckten Arbeitshafen *m* geneigt. (Fig. 60.)

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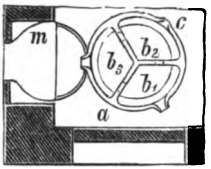
Fig. 60.

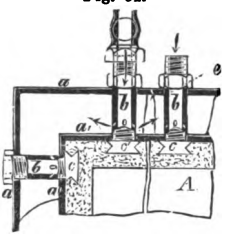


Das Glasgemenge wird in $b^1 b^2$ eingelegt; es schmilzt und fliesst, teilweise geläutert, nach b^3 und von hier nach *m*. Ist die Schnauze von b^3 abgenutzt, so wird der Schmelzhafen um 120° gedreht. Ein anderer Schmelzhafen enthält ein trichterförmiges Gefäss, in welches das Glasgemenge eingelegt wird; es fliesst aus dem Hafen dann ebenfalls in einen Arbeitshafen.

Auch in Bezug auf Wannenöfen sind einige Neuerungen zu verzeichnen.

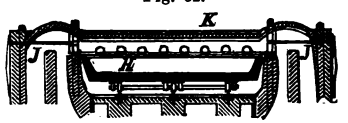
Chr. Aug. Wilh. Schön in Hamburg hat seine gekühlten doppelwandigen Wannen*) weiter ausgebildet. Nach dem D. P. 20952 vom 21. Januar 1881 werden zur Abkühlung doppelwandiger Wannen *A* durch Wasser, Luft oder Dampf hohle Bolzen *b* (Fig. 61) verwendet, welche die doppelten Wände *a a* verbinden, zur regulirbaren Einführung des Kühlmittels dienen und mit schwalbenschwanzförmigen Köpfen *c* die Chamottefütterung halten.

Fig. 61.



Zur Erreichung eines continuirlichen Betriebes wird eine grosse Quantität Glas in einer derartigen Wanne geschmolzen und von dem Hauptschmelzofen nach den einzelnen Arbeitsstellen transportirt, und zwar in Transportwannen *H* (Fig. 62), welche so eingerichtet sind, dass sie zwischen zwei Feuerungen *J* und unter eine mit Arbeitsöffnungen versehene Kappe *K* geführt werden können. Das Glas wird so durch Ueberstreichen der Flamme in weichem Zustande während der Arbeit erhalten.

Fig. 62.



Will man aber aus der Hauptschmelzwanne das in derselben geschmolzene, dünne, flüssige Glas giessen, um Röhren herzustellen, so wird ein Kern benutzt, der aus einem mit Lehm beschlagenen Drahtgerippe besteht, welches gleich nach dem Guss durch Drehung einer centralen Welle unter teilweisem Zerbrechen in seinem Durchmesser etwas verringert wird.

Nach dem Zusatzpatent (D. P. 22273 vom 17. Februar 1881) werden die doppelwandigen Glasschmelzwannen dadurch gekühlt, dass man zwischen den doppelten Wänden gespannte oder ungespannte Dämpfe circuliren lässt.

Auch sein Princip der gekühlten Schachtöfen zum Niederschmelzen von Glas für Giesserei hat Chr. Aug. Wilh. Schön (D. P. 20226 vom 21. April 1881) weiter ausgebildet.*) Zum Einschmelzen von Glas aus abwechselnd aufgegebenen Schichten von Kohle oder Rohmaterial dienen Schmelz-

*) Vgl. Techn.-chem. Jahrb. 1883, S. 84.

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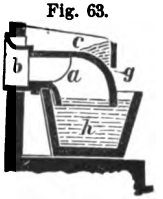
schächte mit Doppelwandungen, die aus Metall construirt und eventuell mit feuerfestem Materlal ausgefüttert sind. Zur Kühlung der Schächte wird zwischen die Doppelwandungen Wasser, kalte Luft oder ungespannter Dampf eingeführt. Diese Schächte werden event. mit Wannen verbunden, wobei man dann, um die Oberfläche des Glases heiss zu erhalten, die Gichtgase der Schächte nach unten und über das Glas leiten kann.

In dieser Art erzeugt man ein dünnflüssiges (sehr heisses) Glas, welches beim Giessen ohne Zuhilfenahme von Pressung die Form scharf ausfüllt. Wenn man Mosaik dadurch herstellen will, dass man nach Muster angeordnete Steine mit dem Glase übergiesst, so würden die Steine sich leicht heben und schwimmen. Es werden daher die Steine in den Formen angestiftet oder beschwert.

Zum Verschluss der Ablassöffnung an Wannen aus denen Glas gegossen wird, dient nach dem D. P. 20185 vom 13. November 1881 von Ch. A. W. Schön ein eiserner Dorn, welcher nicht mit feuerfestem Material umgeben ist. Der Dorn wird durch Einleiten von Wasser etc. gekühlt. Mit der weniger gekühlten Spitze reicht er etwas in die Glasmasse hinein, so dass beim Herausziehen desselben das Glas im Strale mitgezogen wird.

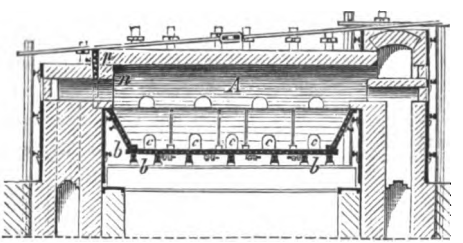
Ferner betrifft das Patent eine Einrichtung an Häfen, welche gestattet, aus denselben continuirlich und aus mehreren Oeffnungen zu arbeiten (Fig. 63). Es wird an dem Hafen eine Haube *a* gesetzt, welche vorn mit zwei Schenkeln noch zwei Arbeitsöffnungen führt; die Schenkel sind in die Manschetten *b* eingesetzt. Die Haube *a* ist sonach etwas beweglich. Auf derselben liegt ein Körper *c*, der mit *a* einen Füllraum bildet, in den Rohglas eingeführt wird. Dieses schmilzt und läuft durch Schlitz *g* in den Hafen *h*.

Fig. 63.



Auch Fritz Lürmann in Osnabrück bringt wassergekühlte Teile und metallene Abstichformen an Glasöfen an. (D. P. 19028 v. 22. Oct. 1882.) An Glas-Schmelz-, Abstich- oder Arbeitsöfen werden als Böden, Seiten, Gewölbeteile, Brücken, Trennungs- oder Filtrirwände gusseiserne, mit eingegossenen, z. B. schmiedeeisernen Röhren versehene, mit einander verbundene Teile, Platten oder Balken benutzt, in denen man Wasser circuliren lässt. Diese Teile werden nicht von dem geschmolzenen Glase angegriffen, zerspringen nicht und werden auch nicht undicht.

Fig. 64.



In der Fig. 64 ist ein Glas-Schmelz- und Abstichofen *A* dargestellt, dessen ganzer Schmelzraum aus wassergekühlten Platten *b* besteht.

Bei einem Ofen, an welchem von zwei Seiten gearbeitet wird, sowie bei

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Oefen mit continuirlichem Betriebe ordnet man für die Beschickung Trichter an; dieselben sind mit der Glasmasse gefüllt, welche darin vorgewärmt wird und reichen von oben durch das Gewölbe bis auf oder in das flüssige Glas; hierdurch wird das alle Ofenteile zerstörende Verstauben der eingesetzten Glasmasse beseitigt, welche deshalb auch nicht angefeuchtet eingetragen zu werden braucht. Dieselbe Beschickungsweise kann für Häfen angewendet werden.

Zum Abstich aus den Wannen werden besondere, leicht auszuwechselnde, d. h. also von der Wandung oder Umhüllung des Glasofens ohne Störung des Zusammenhanges derselben leicht abzulösende und gekühlte Glas-Abstichformen angewendet.

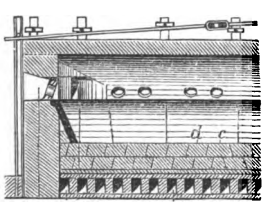
Fig. 64a. Fig. 64a. Fig. 64b. Fig. 64b.

Die Abstichform hat in Fig. 64a eine kreisförmig geschlossene, und in Fig. 64b eine schlitzförmige, unten offene Glas-Abflussöffnung *a*, welche mit einer derselben entsprechend geformten, eisernen Stange geschlossen werden kann. In den Seitenwänden des Ofens (Fig. 64) sind Schlitze *c* angeordnet, in welchen die Glas-Abstichformen befestigt werden können. Man kann sie höher oder niedriger stellen.

Für alle Arten Schmelzöfen ist es wichtig, über dem zu schmelzenden oder schon geschmolzenen Material einen grösseren, die Wärme aufspeichernden und durch Stralung an die zu schmelzende Masse abgebenden Körper zu haben. Zu dem Ende ist an der Fuchsseite in dem Gewölbe ein Absatz *n* angeordnet. Um denselben vor Abschmelzen zu bewahren, ist ein mit Wasser gekühltes Bogenstück *p* eingesetzt.

Nach dem Zusatzpatent (D. P. 19820 vom 8. Februar 1881) ist die Sohle des Ofens aus einer oder aus mehreren Lagen von Steinen (in der Zeichnung zwei) hergestellt, welche als Rhomben oder abgestumpfte Pyramiden geformt und so aneinander gefügt sind, dass der mittelste Stein *c* von den zunächst umliegenden, die Steine zweiter Reihe *d* von denjenigen dritter Reihe etc., die vorletzte und letzte Reihe von der ganzen darauf ruhenden Last der Seitenwände incl. Gewölbe des Ofens niedergehalten werden. Durch diese Construction der Sohlen der Glasöfen wird der Auftrieb der Boden- oder Sohlsteine unmöglich gemacht.

Fig. 65.



In dem D. P. 20840 vom 20. Januar 1881 beschreibt Lürmann elf Combinationen von Glasöfen mit Gröbe-Lürmann'schen Generatoren.

Die Unterschiede finden sich in der Lage der Generatoren *AB*, in der Lage der Lufterhitzer *C*, welche nach Ponsard's System (nach dem Gegen-

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stromprincip) gebaut sind, in der Anordnung der Gas- und Luftcanäle bezw. Einströmungsöffnungen, ferner in der Anordnung der Abhitzeöffnungen und in der Richtung des Zuges im Ofen.

Als Neuerung wird für diese Combinationen und auch für Gasöfen mit anderer Beheizungsart beansprucht die Trennung der Feuerbrücke *s* und der Fuchsbrücke *t* von den übrigen Teilen des Glasofens (Fig. 66 und 67).

Die reguläre Beheizung des Ofens (Fig. 66 und 67) erfolgt so, dass das Gas aus den Generatoren durch den Canal *g* in den Ofen eintritt, hier mit Luft verbrennt, welche (gefiederte Pfeile) in den senkrechten Canälen *o* des Lufterhitzers erhitzt ist und bei *p* in den Ofen strömt, während die Feuergase (ungefiederte Pfeile) bei *n* austreten, die horizontalen Canäle *m* des Lufterhitzers und dann die um die Entgasungsräume *A* gelegten Abhitzecanäle *k* durchziehen. Hier sind nun noch zwei neue Arten von Gascanälen angelegt. Durch beide wird die Benutzung des Gases ermöglicht, wenn die Arbeit im Ofen zeitweise vermindert oder eingestellt wird. Es wird dann das Gas wie in Fig. 66 und 67 zur zeitweise directen Erhitzung der bereits genannten Abhitzecanäle *k* verwendet, indem man es in den mit diesen Canälen communicirenden Raum *i* leitet und hier mit zugeleiteter Luft verbrennt.

Fig. 66.

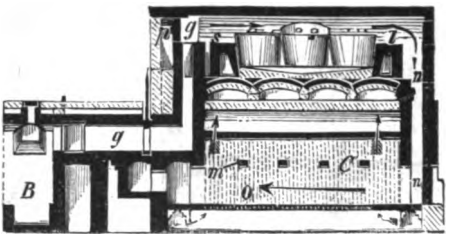
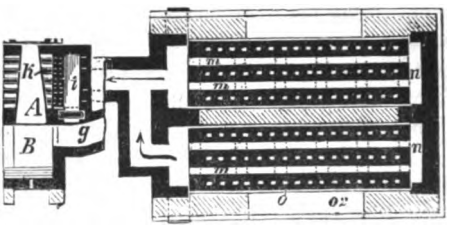
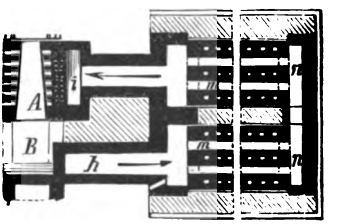


Fig. 67.



Nach der in Fig. 68 dargestellten Anordnung wird in diesem Falle das Gas zur zeitweise stärkeren Erhitzung der Lufterhitzer benutzt, indem man es direct durch den Canal *h* in die Abhitzecanäle *m* der Lufterhitzer einleitet und dort verbrennt; die Verbrennung circulirt dann in der einen Hälfte der Lufterhitzer umgekehrt, wie bei der regulären Führung.

Fig. 68.



In ähnlicher Weise kann man auch bei intermittirend wirkenden Lufterhitzern (System Siemens) die Gase zeitweise direct in denselben einleiten und dort verbrennen.

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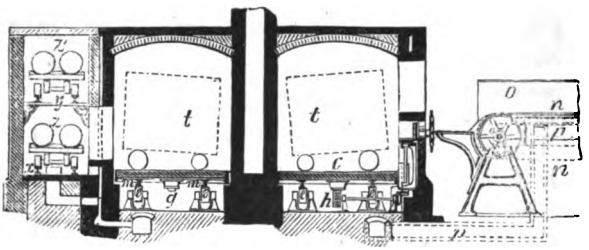
II. Verarbeitung des Glases.

Christ. Aug. Wilh. Schön in Hamburg hat einen continuirlichen Glaskühlofen construirt (D. P. 19207 vom 17. September 1880, Fig. 69).

In dem ringförmigen Kühlofen dreht sich eine Drehscheibe *c*, welche mit an derselben befestigten kreisförmigen Schienen *m* auf Rollen *e* läuft. Unter der Scheibe befindet sich eine kreisförmige Zahnstange *g*, in die ein von aussen in Bewegung gesetzter Trieb *h* eingreift. Auf der Drehscheibe stehen die auf Rädern laufenden Kühlkästen *t*. Der Kühlraum wird durch Schieber in mehrere Abteilungen geteilt, von denen die eine durch Gas geheizt wird. Wenn der Ofen zum Kühlen von geblasenem Hohlglas gebraucht wird, so wird er mit dem Glasofen durch einen Transporteur verbunden. Derselbe besteht aus einer Kette *n* ohne Ende, welche in einer Rinne *o* läuft. Diese Rinne wird dadurch erwärmt, dass die Canäle *p*, welche das Heizgas nach dem Kühlofen leiten, darunter angelegt sind.

Fig. 69.

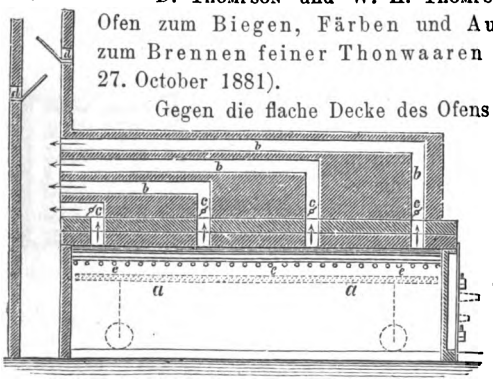


Soll der Ofen zum Kühlen von Tafelglas dienen, so werden die Strecköfen in grösserer Anzahl um denselben herumgelegt.

Die Strecköfen sind durch Schieber in eine Heizkammer und eine Streckkammer geteilt; zugleich sind sie zweietagig, so dass zwei Schienengeleise *x* und *y* je durch die Kammern laufen. Die auf dem oberen und auf dem unteren Geleise laufende Wagen $z z^1$ befinden sich abwechselnd in der Heizkammer und in der Streckkammer.

Fig. 70.

D. Thompson und W. H. Thompson in Leeds haben einen Ofen zum Biegen, Färben und Ausglühen von Glas und zum Brennen feiner Thonwaaren patentirt (D. P. 19005 vom 27. October 1881).



Gegen die flache Decke des Ofens sind zwei Reihen Bunsenscher Brenner *e* gerichtet, um besonders die Decke zu erhitzen. Durch die an diese ausgestralte Wärme werden dann die auf Wagen *a* eingeschobenen Gegenstände erhitzt. Die Wärme im Ofen wird durch Züge *b* und Klappen *c* regulirt.

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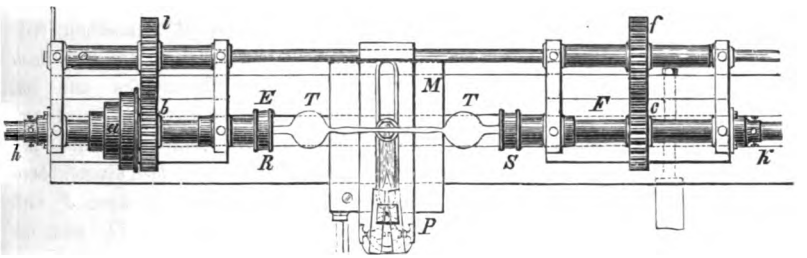
Der Zug des Schornsteins kann mittelst der Oeffnungen *d*, vor denen innen schräge Platten angebracht sind, regulirt werden.

Eine Maschine zum Blasen von Gegenständen aus Glasröhren rührt von Frank Wright und Mat. W. Wallbank Mackie in London her. (D. P. 22093 vom 1. September 1882; Fig. 72.)

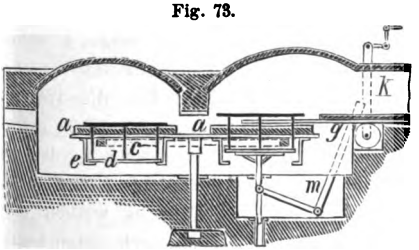
Fig. 72.



Zwei hohle Röhren *E* und *F* werden mit gleicher Geschwindigkeit gedreht; der Antrieb erfolgt bei *a*; die Bewegung wird von *b* auf *l* und von *f* auf *c* bezw. *F* übertragen. Röhre *F* ist auf einem Schlitten verschiebbar. Die Röhren *E* und *F* tragen vorn Muffen *R* und *S*, die innen mit elastischem Material ausgekleidet sind und zum Einklemmen der Glasröhren *T* dienen. Am anderen Ende von *G* und *F* sind Schläuche *hk* angesetzt, die mit comprimirte Luft enthaltenden Reservoiren communiciren. Die zu bearbeitende Röhre wird durch Gebläse *P* erhitzt, das auf Schlitten *M* beweglich ist.

Joseph Hirsch in Radeberg giebt Neuerungen an Strecksteinen und in dem Verfahren zum Abheben der Glasplatte und Ueberführen derselben in den Brévez'schen Kühlcanal an. (D. P. 22022 vom 8. August 1882.) Um die gestreckte Glastafel von der Streckplatte nicht mit der gebräuchlichen Gabel abheben und in den Kühlofen überführen zu müssen, sind die Streckplatten *a* durchlöchert. Durch diese Löcher reichen mehrere Stifte *c*, die unten an einer Blechplatte *d* sitzen. Platte *d* liegt gewöhnlich auf Winkeln *e* auf, wobei dann die Stifte *c* nur bis an die Oberfläche des Steines reichen. Gelangt aber die hier auf einer Drehscheibe angeordnete Kühlplatte vor den Kühlcanal *k*, so hebt man *d* mittelst des hier befindlichen Hebemechanismus *m* und kann dann die Kühlofenschienen *g* unter die Glasplatte schieben, diese mit jenen von den Stiften *c* abheben und auf die Sohle des Kühlofens legen.

Fig. 73.



Julius Fahdt in Dresden hat folgende Maschine zum Pressen von

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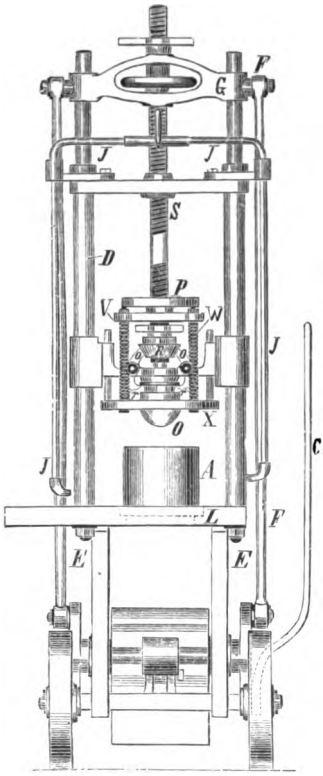
Fig. 72.



Glas construirt. (D. P. 20985 vom 9. November 1881.) Der Presskopf *P* ist an Spindel *S* einstellbar und wird von dem Handhebel *C*, den Kurbeln *E*, Zugstangen *F* und Querstück *G* bewegt. An *P* sitzen die Klauen *o r*, welche den Stempel *O* tragen und durch Niederschrauben von *R* denselben festhalten. *X* ist eine Platte, die sich beim Niedergehen des Presskopfes auf den Rand der Form *A* legt; sie wird von zwei Federn *W* getragen, die mit dem andern Ende an der einstellbaren Scheibe *V* sitzen. Durch Röhren *J* wird Luft gegen den Stempel *O* und die Form *A* geblasen, um sie zu kühlen.

Die Form *A* ist nicht geführt; ihre Einstellung wird nur durch Anschläge gesichert. Da der Tisch unter *A* sehr angegriffen wird, so ist hier eine Hartgussplatte *L* eingelegt.

Ferner hat J. Fahdt seinen Apparat zum Schneiden von Glaswaaren und zum Poliren von Schnittflächen*) vervollkommnet, insofern die durch Absprengen erhaltenen scharfen Kanten von Glaskörpern verschmolzen werden. (D. P. 19333 vom 29. November 1881.) Die Träger *t*, welche die Glaskörper, hier Lampencylinder *K*, tragen, drehen sich mit den Wellen *v* in zwei hinter einander liegenden Rädern *a* (Fig. 73). Um die Träger *t* stets in senkrechter Stellung zu erhalten, ist an dieselben bei *z* ein excentrischer Ring *b* frei schwebend angehängt. Durch ein Schaltwerk werden die Räder *a* ruckweise gedreht und so die Gläser vor die Brenner *f* gebracht. Mittelst einer über die Gläser hinweglaufenden Schnur *n* werden dieselben stetig gedreht. Diese Drehung kann den Gläsern auch durch kleine Frictionsrollen erteilt werden, welche an den Enden von *t* sitzen und durch Schnüre bewegt werden.

S. Reich & Co. in Wien und Berlin stellen helle durchsichtige Muster auf mattirten Glasflächen her, indem ein mattirter Glasgegenstand mit einem leicht schmelzbaren Glassatz bestrichen oder bedruckt und dann aufgebrannt wird. Der Glassatz schmilzt, wobei die von ihm bedeckten Stellen durchsichtig werden. (D. P. 21540 vom 18. Juli 1882.)

*) Vgl. Techn.-chem. Jahrb. 1883, S. 86.

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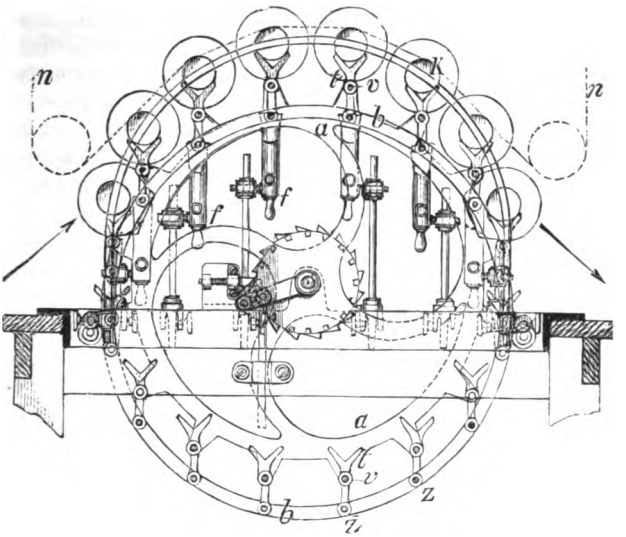
Fig. 73.



W. Preussler in Liegnitz stellt eine gepresste Emailschicht auf Glas her, indem eine im halbtrockenen Zustande sehr zähe Masse aus trocknem Email, dickem Kienöl und Dammarlack auf das Glas aufgetragen wird. Nach dem Antrocknen wird die Bemalung eingepresst, indem man sie mit gezahnten Rädchen überfährt oder indem man gepresstes Papier, Tüll etc. auflegt und die Erhabenheiten derselben mittelst Gummiwalze oder Bürste in das Email eindrückt. Das Email wird dann gebrannt. Es lassen sich so die Formen der Figur in schwachem Relief wiedergeben. (D. P. 22091 vom 25. Juli 1882.)

Zur Herstellung von sogenanntem Kathedralglas werden nach Alois Freystadel in Hannover (D. P. 22306 vom 9. August 1882) farbig überfangene oder durch die ganze Masse gefärbte, geblasene oder gegossene Glastafeln mit einem durch Wasser zu einem Brei angerührten Gemisch von gleichen Teilen pulverisirtem Basalt, Potasche, Salpeter und calcinirtem Borax überstrichen und nach dem Trocknen einer Glühhitze ausgesetzt, welche hinreichend ist, die aufgetragene Mischung zu schmelzen, wobei gleichzeitig die Glastafel mit erweicht wird, deren Abkühlung dann auf bekannte Weise erfolgt.

Um feinlinige Ornamente, welche Intarsien ähneln, auf Glas herzustellen, wird nach H. Deutsch in Zweibrücken (D. P. 22248 vom 27. Juni 1882) das Glas mit einem gefärbten Lack überzogen.' In den noch nicht festen Lack wird das Ornament mit einem Stift radirt, dann wird die Zeichnung mit dünner Leimlösung bestrichen und mit Blattmetall belegt. Nach dem Trocknen erhält dieses zunächst einen Anstrich mit einer spirituösen Schellacklösung, dann mit Lack oder Oelfarbe.

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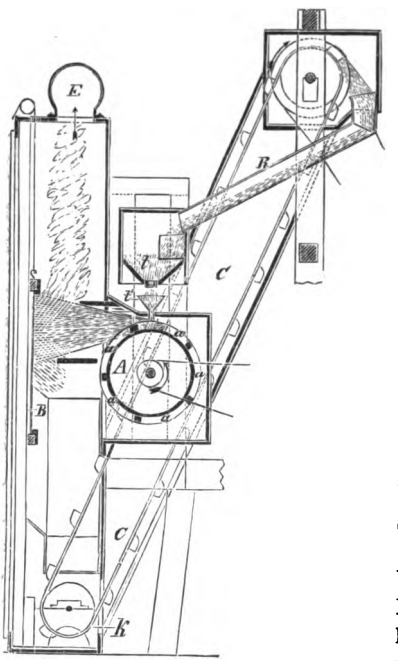
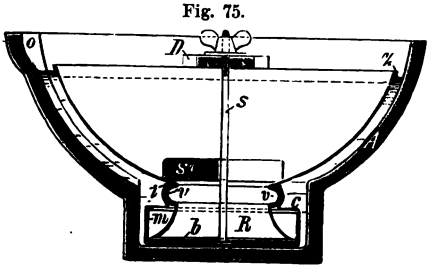
W. Schell in Offenburg mattirt Glas etc. mittelst Sandstralgebläse nach dem D. P. 20311 vom 28. April 1882 folgendermaassen: Eine Trommel *A* ist auf ihrem Umfange durch Längs- und Querleisten von Gummi in eine Anzahl Fächer *a* eingeteilt. Die Trommel *A* ist bestimmt, das auf sie gelangende Mattirpulver gegen das zu bearbeitende Object *B* zu schleudern, und wird zu diesem Zweck schnell gedreht. Das Mattirpulver fällt unten in einen Kasten *k*, aus welchem es durch ein Paternosterwerk *C* wieder in die Höhe gehoben wird. Durch eine Rinne *R* gelangt es nach einem Haupttrichter *t* und durch einen zweiten Trichter *t*¹ auf *A*. Durch diese Vorrichtung wird das Mattirmaterial in stetem Kreislauf wieder auf die Walze *A* geschafft und auf deren Umfang gleichmässig verteilt. Der Staub zieht durch ein Rohr *E* ab.

Fig. 74.



G. Franke in Hamburg hat eine Vorrichtung zum Versilbern und Lackiren einwandiger Lampenkuppeln angegeben. (D. P. 20743 vom 20. Mai 1882.) Die Halsöffnung wird durch eine Blechkapsel *m* verschlossen, welche auf dem Boden die Dichtungsscheibe *b* aus Filz oder Gummi etc. hat und mittelst eines aus Weichgummi hergestellten Beutels *c* über dem Kuppelhals festgeklemmt wird. Ein Holzstück *D*, welches quer über den weiten Kuppelrand gelegt ist, wird durch eine Schraube *s* mit dem Verschluss verschraubt. Der Halswulst *v* ist vorher mit einem Gummiring bekleidet, um ganz scharfe Abschlusslinien für den Silberspiegel sowol, als für den späteren Lacküberzug zu erhalten. Auch das weite Ende der Kuppel wird mit einem Gummibandring *z* umspannt. Bleigewicht *s*¹ dient zum Beschweren. Man giesst die Silberlösung bis zur Höhe der Ringe *z* in das Gefäss, welches zu dem Zweck eine seitliche Nut *o* erhält. Beim Eintauchen in die Lacklösung wird die

Fig. 75.



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weite Mündung der Kuppel durch einen Blechboden und einen Gummiring verschlossen.

W. Hasenöhrl und G. Steingraber in Wien schützen nach dem D. P. 19584 vom 14. Januar 1882 die Silberschicht von Spiegeln, indem dieselbe zunächst mit einem Gemenge von Zinkstaub und fein verteiltem Kupfer bedeckt wird. Dann wird der Spiegel in dasjenige Metallbad gebracht, in welchem er auf galvanischem Wege mit der eigentlich schützenden Metallschicht bedeckt wird. Hierbei wird die negative Elektrode über dem Spiegel oder dieser unter der Elektrode hin- und herbewegt. Ist ein genügend starker Metallniederschlag erzeugt, so wird derselbe eventuell noch mit einem Anstrich versehen.

Statistik.

Im Deutschen Reich betrug, in metr. Centnern ausgedrückt, die

Waarengattung.	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an grünem und anderem naturfarbigem gemeinem Hohlglas (Glasgeschirr)	1 722	1 677	436 158	481 481
„ weissem Hohlglas, ungemustert, ungeschliffen etc. . .	2 409	2 562	91 508	97 242
„ Fenster- und Tafelglas, grün, halb und ganz weiss, ungeschliffen etc.	7 565	7 090	26 565	31 904
„ Spiegelglas, roh, ungeschliffen	30 603	30 798	7 838	8 492
„ Tafel-(Fenster-) und Spiegelglas geschliffen etc., mit Ausnahme des belegten . . .	834	915	31 247	28 276
„ Tafel- (Fenster-) und Spiegelglas belegt	432	531	31 259	30 110
„ gepresstem, geschliffenem, polirtem, abgeriebenem etc. Glas	5 104	4 894	22 972	24 639
„ farbigem und bemaltem etc. Glas	5 325	5 566	6 010	5 929

XVII. Thonwaaren.

I. Allgemeines. Geschichte.

Die Thone und die Thonwaarenindustrie Bayerns von Laubmann, Fortsetzung. Thonind. Ztg. 1882 S. 21, S. 28, S. 37.

Die sächsische Thonwaarenindustrie, Thonind. Ztg. 1882, S. 54.

Tarentiner Terracotten, F. Jaennicke, Thonind.-Ztg. 1882 S. 360. Römische Backsteine und Ziegel, ders., Sprechsaal, Thonind. Ztg. 1882 S. 413.

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Für die Entwickelung der Berliner Porcellanindustrie sehr interessant ist ein Fund von etwa 30 Tonnen alter, zur Verarbeitung fertiger Porcellanmasse, die wahrscheinlich aus der 1757 eingegangenen Wegeli'schen Fabrik stammt. H. Seger hat die Masse untersucht. Die Porcellanmasse bestand aus 15 bis 18 Proc. Feldspath und 82 bis 85 Proc. Porcellanerde. Der Feldspath enthielt mehr Natron und Kalk und weniger Kali als der jetzt gebrauchte Orthoklas, es scheint vielmehr ein Oligoklas mit geringem Kieselsäuregehalt angewendet worden zu sein. Quarz fand sich in so geringer Menge, dass ein absichtlicher Zusatz desselben jedenfalls nicht stattgefunden hat. Beim Brennen schwindet die Masse stärker als Berliner Masse, sie wird gelblicher und weniger transparent; sie zeigt grosse Neigung zum Winden und zum Hervortreten der Formnähte (Thonind. Ztg. 1882 S. 467).

F. Jännicke macht einige Mitteilungen über Preise, Nachahmung und Erkennung von Sèvres-Porcellan (Thonind. Ztg. 1882 S. 109), ferner über Wertschätzung von Chelsea-Porcellan (das. S. 139); er bespricht ferner die Authenticität des Lowestoft-Porcellans (Thonind. Ztg. 1882 S. 151) und giebt Neues über indische Keramik (Thonind. Ztg. 1882, S. 185, S. 192).

Stegmann, Zur Geschichte der deutschen Töpferkunst, Fürstenberger Porzellanfabrik, Thonind. Ztg. 1882 S. 238, 247, Fabrik in Höchst, das. S. 248, in Cassel, 257, Weesp b. Amsterdam, Plötzkau a. Saale, Seeheim b. Darmstadt, Schrezheim b. Ellwangen, S. 258.

II. Vorbereitung der Rohmaterialien.

Die Compagnie générale des Kaolins d'Auvergne will nach Thonind. Ztg. 1882, S. 159, den Kaolin auf trockenem Wege von beigemengtem Sand trennen, indem sie ihn zuerst in der Weise zerreibt, dass die Sandkörner nicht in zerkleinert werden, sondern nur der Kaolin von den Sandkörnern sich ablöst. Das Product wird dann durch einen Ventilator in Absatzkammern geblasen, in denen sich der Sand früher als der Kaolin absetzt, der so getrennt wird.

Lietzmann in Königs-Wusterhausen (D.P. 21913 vom 22. August 1882). Continuirliche Mischmaschine für pulverförmige Materialien.

Bergmann in Niedersedlitz (D. P. 19006 vom 23. November 1881) will Mantelplatten für Trommelnassmühlen aus Feldspath schmelzen. In eine feuerfeste Kapsel wird das Modell für die Mantelplatten eingesetzt und der übrige Raum mit feuerfestem Sand ausgestampft. Dann wird das Modell herausgehoben und der leere Raum mit gemahlenem Feldspath gefüllt. Die so beschickte Kapsel wird nun gebrannt, wodurch der Feldspath zu einer Mantelplatte zusammenschmilzt. Nach dem Erkalten ist die rohe Platte zum Zusammenschleifen fertig.

Der continuirlich wirkende Schlämmapparat von Ramberg in Helsingborg (D. P. 22021 vom 26. Juli 1882) ist in der oberen Hälfte von Figur 76 als Ansicht, in der unteren Hälfte als Schnitt dargestellt.

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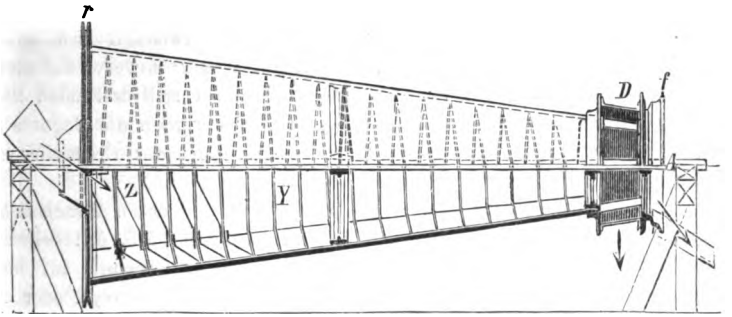
Der Schlämmapparat besteht aus einer inwendig mit einer Spirale *Y* und mit zwischen den Spiralwindungen der Quere nach angeordneten

Fig. 76.



Schneidemessern *Z* versehenen konischen Trommel, welche an ihrem Hinterende für das Abscheiden der gröberen Teile aus Rosten *D* construirt ist. Die Trommel wird vermittelst der Schnurscheibe *r* gedreht. Thon und Wasser treten links ein; die Schlämme fliesst durch die Oeffnungen der Roste *D*, während Steine etc. am Ende ausgeworfen werden.

III. Porcellan.

Buchholtz & Neddermann in Strassburg, Elsass, haben in D. P. 21418 vom 16. März 1882 weitere Neuerungen in dem Verfahren der Herstellung poröser Mahlkörper aus Porcellan angegeben. Korkabfälle werden stark getrocknet, gemahlen und sortirt. Sie werden dann in Wasser gelegt, wobei sie stark aufquellen, und hierauf der Porcellanmasse beigemischt. Beim Trocknen schrumpfen die Korkteile sehr stark ein, so dass sie ganz lose in den Höhlungen des Porcellans liegen. Die Korkteile verbrennen aus diesem Grunde beim Brande des Porcellans besser als die früher beschriebenen Massen und geben ausserdem unregelmässig geformte griffige Poren in dem Mahlkörper.*)

Die K. K. priv. Graf v. Thun'sche Porcellanfabrik in Klösterle hat sich in D. P. 22316 vom 21. September 1882 (Zus. zu No. 3105) eine Herstellung von durchweg glasirten Porcellansieben patentiren lassen, wonach die sich konisch erweiternden Schlitze an der schmalen Seite durch zwei dünne Balken in drei Teile getrennt sind.

Glasur. — Zur Befreiung der Emailglasur von Eisenspänen wird in der Thonind. Ztg. 1882, S. 230 empfohlen, 2 kräftige Hufeisenmagnete an den Armen der Blockmühle so aufzuhängen, dass sie mit den beiden Polen etwa 5 cm tief in den Schlamm eintauchen und beim Mahlen mit herumgeführt werden. Sie werden beim Mahlen wiederholt herausgezogen und abgewischt. Bereits gemahlene Glasur wird in der Wanne $^1/_4$ bis $^1/_2$ Stunde mit dem Magneten, der wiederholt abzuwischen ist, gerührt. Bei nur gepochter Glasur

*) Techn.-chem. Jahrb. 1882, S. 213.

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mit dem Magneten zu arbeiten, ist nicht zu empfehlen, da die Eisenspäne in dem groben Pulver vielfach noch festgeschmolzen sind.

Zur Reinigung staubförmiger, flüssiger oder halbflüssiger Massen von Eisen benutzt Eachran in Greenock (D. P. 18598 vom 19. November 1881) einen Apparat mit Magneten, die schmale Schlitze zwischen sich lassen, welche das Material zu passiren hat. Die Magnete sind entweder auf einem hin- und herschwingenden Rahmen oder auf einem sich drehenden Rade befestigt. Durch Bewegen des Rahmens oder Rades werden die Magnete an Bürsten mit untergestellten Kästen zur Abstreichung der Eisenteile vorbeigeführt.

Eine eingehende Arbeit über Glasurfehler und deren Ursachen hat H. Seger, Thonind. Ztg. 1882, S. 227, 237, 246, 255, 265, 331 geliefert. Die Glasuren sind Verbindungen von Kieselsäure oder Borsäure mit basischen Flussmitteln, wie Kali, Natron, Kalk, Magnesia und Bleioxyd, oder mit färbenden Flussmitteln, wie Kobaltoxydul, Nickeloxydul, Manganoxyd, Eisenoxyd und Eisenoxydul, Kupferoxyd und Kupferoxydul, Chromoxyd, Uranoxyd oder geringe Mengen von Gold oder Iridiumsesquioxyd. Die Thonerde steht zwischen Säuren und Basen und spielt eine eigenthümliche und charakteristische Rolle; sie fehlt nur in den leichtest flüssigen Glasuren. Eine Trübung wird in den Glasuren hervorgebracht durch Zinnoxyd, Antimonsäure, Arsensäure, phosphorsauren Kalk oder einen reichlichen Gehalt an Thonerde. Die leichtschmelzbarsten Glasuren für gewöhnliches Irdengeschirr und feine französische Fayence haben die Formeln $RO \cdot 1.5\ SiO_2$ bis $RO \cdot 3\ SiO_2$ entsprechend den sehr leicht schmelzenden optischen und Bleikrystallgläsern. Härtere Glasuren des deutschen und englischen Steinguts:

$$RO \cdot 0.1\ Al_2O_3 \cdot 2.5\ SiO_2 \text{ bis } RO \cdot 0.4\ Al_2O_3 \cdot 4.5\ SiO_2.$$

Porcellanglasuren: $RO \cdot 0.5\ Al_2O_3 \cdot 5\ SiO_2$ bis $RO \cdot 1.25\ Al_2O_3 \cdot 12\ SiO_2$. Die Glasuren sollen, wie die Gläser, immer gemischte Silicate darstellen, weil nur so der ausgesprochene glasige Charakter hervortritt. Bei den am leichtesten schmelzbaren Glasuren, deren Glattbrandtemperatur etwa bis zur Silberschmelzhitze reicht, überwiegt als Flussmittel in der Praxis stets das Bleioxyd. Bei den streng flüssigeren Steingutglasuren mit Schmelztemperaturen von Silberschmelzhitze bis nicht weit über Goldschmelzhitze tritt das Bleioxyd immer mehr mit der geforderten Strengflüssigkeit in den Hintergrund, und Kali, Natron, Kalk, Magnesia, Baryt, daneben Thonerde treten als Flussmittel in den Vordergrund. Bei den sehr strengflüssigen Porcellanglasuren, deren Schmelzpunkt sich über denjenigen des Schmiedeeisens, oft bis nahe dem des Platins, also blendende Weiss- oder Blauglut, erhebt, fehlt mit Ausnahme einiger weniger Glasuren des weicheren chinesischen Porcellans das Bleioxyd gänzlich; dieselben enthalten nur alkalische und alkalischerdige Flussmittel.

Die Art des Ueberziehens der Gefässe mit der Glasur durch Eintauchen oder Begiessen macht es nötig, dass alle Glasurbestandteile sich in einem in Wasser unlöslichen Zustande befinden. Lösliche Stoffe müssen daher

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mit Sand, Feldspath u. dgl. zu einem leicht flüssigen Glase gefrittet werden, das feingemahlen den übrigen Bestandteilen beigemischt wird. In einzelnen Fällen, so bei Email für gemeine Fayence, werden alle Glasurbestandteile zusammengefrittet und nach dem Auswaschen der von dem Glasflusse nicht aufgenommenen Salze (zumeist Kochsalz) direct als Glasur verwendet.

Damit die Glasur nicht abfliesst oder von dem Scherben aufgesogen wird, kann sie beim Aufschmelzen nur bis zu einer zähflüssigen Consistenz erhitzt werden. Um hierbei doch ein homogenes Glas zu erhalten, müssen die Bestandteile sehr fein gemahlen und im Schlamm gut durcheinander gerührt werden. Eine Ausscheidung der Luftbläschen ist sehr erschwert und die Ausscheidung solcher Verunreinigungen unmöglich, welche von dem sich bildenden Glase nicht aufgenommen werden, und die bei dem gewöhnlichen Glase als „Galle" abgezogen werden können. Es ergiebt sich hieraus, dass die Rohstoffe für Glasur reiner und sorgfältiger vorbereitet als bei der Glasfabrikation sein müssen.

Thonerde erhöht, ebenso wie die Kieselsäure, den Schmelzpunkt der Glasuren. Durch Einführen von Thonerde kann man den Schmelzpunkt erhöhen und zugleich die Basenmengen herabdrücken, was vermuthen lässt, dass die Thonerde nicht, wie vielfach angenommen wird, als solche sich im Glase auflöst, sondern dass sie vielmehr auch ein Silicat bildet. Rechnet man $Al^2O^3 = 3\,RO$, so hat man für Steingutglasuren (s. oben) $1.3\,RO \cdot 2.5\,SiO^2$ bis $2.2\,RO \cdot 4.5\,SiO^2$ d. i. 1.92 bis 2.05 fach saures Silicat, für Porcellanglasuren $2.5\,RO \cdot 5\,SiO^2$ bis $4.5\,RO \cdot 12\,SiO^2$ d. i. 2 bis 2.55 fach saures Silicat. Es kommen somit die gebräuchlichen schwerflüssigen Glasuren in Bezug auf ihre Säuerungsstufe der für das Glas nach praktischen Erfahrungen geforderten nahe, dass sie $2^1/_2$ fach saure Silicate seien, sich der Zusammensetzung 3 fach saurer aber nicht sehr nähern dürfen, wenn nicht eine Neigung zum Blindwerden durch Entglasung bei langsamer Erkaltung, die ja bei der Herstellung der Thonwaaren meist nicht zu vermeiden ist, eintreten soll. Die Glasur muss die Säuerungsstufe eines 2 fach sauren Silicates überschreiten, weil sie sonst abfliesst oder eingesogen wird, besonders wenn sie arm an Thonerde ist. Man kann ausser durch Erhöhung der Kieselsäure bezw. durch Erniedrigung der Flussmittel auch die Schmelzbarkeit dadurch erhöhen, dass man weniger intensive Flussmittel anwendet, so z. B. einen Teil Bleioxyd durch Alkalien etc. nach äquivalenten Verhältnissen ersetzt. Man kann zu gleichem Zwecke auch die Zahl der Flussmittel vermindern, so Kali und Natron durch Kali oder Natron, Kalk und Magnesia durch Kalk oder Magnesia nach äquivalenten Verhältnissen ersetzen. Bei Erhöhung der Schmelzbarkeit durch Thonerde, event. unter Zugabe von Kieselsäure, kann man sich der unteren Grenze, den 2 fach sauren Silicaten, eher nähern oder sie auch erreichen, weil bei erhöhtem Thonerdegehalt ein zu dünner Fluss weniger zu befürchten, eine Entglasung aber um so sicherer vermieden wird. Ersatz von Borsäure durch Kieselsäure erhöht ebenfalls die Schmelzbarkeit.

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Durch ungleiche Ausdehnung bei der Abkühlung von Glasur und Scherben entstehen Spannungen. Zieht sich die Glasur stärker zusammen so entstehen Haarrisse beim Abkühlen oder stärkere Risse nach längerer Zeit. Zieht sich der Scherben stärker zusammen, so wird die Glasur abgeworfen, und zwar besonders an stark gekrümmten Flächen, wobei dann Stücke des Scherbens, Ansätze etc. mit abgerissen werden.

Der Ausdehnungscoefficient des Scherbens wird vermindert durch Vermehrung des plastischen Bindemittels und gleichzeitige Verringerung des Quarzgehaltes, durch Ersatz von plastischem Thon durch Kaolin, durch Vermehrung des Feldspaths, durch weniger feine Mahlung des Quarzsandes und schwächeren Brand des Scherbens (beim ersten, meist stärkeren Brand). Diese Mittel sind beim Abspringen der Glasur anzuwenden. Bei Haarrissen die entgegengesetzten.

Bei derselben Menge von Basen, z. B. $^1/_2$ PbO, $^1/_2$ Na^2O, wird die Glasur bei zunehmendem Gehalt an Kieselsäure, z. B. 2.5 SiO^2 bis 3 SiO^2, schwerer schmelzbar (hier von 600° bis 960°) und zugleich nimmt der Ausdehnungscoefficent ab. Durch Einführung von Borsäure statt Kieselsäure z. B. von
($^1/_2$ PbO, $^1/_2$ Na^2O) (2.4 SiO^2, 0.1 BO^3) bis ($^1/_2$ PbO, $^1/_2$ NaO) (2 SiO^2, 0.5 BO^3), wird die Schmelzbarkeit vermindert und zugleich der Ausdehnungscoefficient verringert.

Bei Ersatz von Bleioxyd durch andere Oxyde nimmt die Schmelzbarkeit und zu gleicher Zeit der Ausdehnungscoefficient ab in der Reihe (Pb, Na), (Pb, K), (Ba, Na), (K, Na), (Na, Mg).

Durch Einführen von 0.1 bis 0.3 Aeq. Thonerde in die Glasur ($^1/_2$ PbO, $^1/_2$ Na^2O) 2.5 SiO^2 erhöht man den Schmelzpunkt rasch, wobei die Glasuren zugleich trübe, emailartig werden, in dem Ausdehnungscoefficienten erscheint jedoch kein Unterschied.

Bei derselben Zusammensetzung des Scherbens muss man daher in der Glasur bei Haarrissigkeit a) die Kieselsäure erhöhen, bezw. den Flussmittelgehalt erniedrigen. Wird zuviel Kieselsäure erforderlich, so muss man gleichzeitig Thonerde einführen. Durch Erhöhung von Kieselsäure und Thonerde wird die Glasur strengflüssiger. b) Borsäure statt Kieselsäure einführen; hierdurch wird die Glasur schmelzbarer. c) Die Flussmittel mit hohem Aequivalentgewicht durch solche mit niedrigerem ersetzen; hierbei wird der Schmelzpunkt erhöht. Bei Abspringen der Glasur sind die entgegengesetzten Massnahmen erforderlich.

Die Erscheinungen, dass dieselbe Glasur bei lang andauerndem und hohem Glasurbrand rissefrei haftet, die bei kurzem und niederem Glasurbrand haarrissig wird, und dass die Haarrissigkeit besonders bei dickeren Glasurschichten eintritt, erklären sich dadurch, dass die Glasur bei längerem und stärkerem Brande oder in dünner Schicht mehr Thonerde und Kieselsäure aus dem Scherben aufnimmt.

Von Verunreinigungen der Glasurbestandteile erweisen sich die

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Salze flüchtiger Säuren, wie Kohlensäure, Essigsäure und Salpetersäure, und auch von Phosphorsäure als unschädlich.

Chlormetalle sind oft schädlich; sie werden erst bei hoher Temperatur und bei Gegenwart von Wasserdampf zerlegt. Man entfernt sie durch Auswaschen der Glasur oder der Fritte.

Schwefelsaure Salze verleihen besonders kalihaltigen Glasuren die Eigenschaft zu beschlagen; es tritt ferner ein völlig dauerndes Erblinden der Oberfläche und die Entstehung von Bläschen ein. War selbst die Glasur völlig klares Glas, so kann beim Aufschmelzen schwefelsaures Natron abgeschieden werden, weil die Glasur beim Aufschmelzen saurer wird und sich Na^2SO^4 in saureren Silicaten weniger gut löst. Es bildet sich so eine Schicht „Galle". Zugleich tritt durch Austreiben von etwas Schwefelsäure eine Gasentwickelung ein, es entstehen Blasen, deren Platzen durch die Galle verhindert wird. Wenn man dann mit der Hand über die erkaltete Glasur streicht, so platzen die Blasen, die scharfen Ränder schneiden etwas von der Haut weg, es entstehen schwarze Punkte. Das sogenannte Vertrocknen der Glasur an den Rändern ist meist auf Sulfate zurückzuführen. Bei reducirendem Brand (z. B. Porcellan) sind Sulfate unschädlich.

Gleichmässige Glasur kann nur auf gleichhart und blasenfrei gebranntem Scherben entstehen; ferner darf der Scherben nicht zu weich verglüht werden und muss gut abgefegt sein. Zu leicht verglühtes Porcellan erhält beim Brande pockenförmige Erhöhungen.

Das Auftragen der Glasur auf rohen Thon (ordinäres Töpfergeschirr, Bunzlauer Steinzeug) geschieht am besten, wenn derselbe lederhart ist, weil so das Aufweichen am wenigsten eintritt.

Farben, wie Chromoxyd, Kobaltoxyd-Thonerde, stossen leicht die darüberliegende Glasur ab und müssen dann vorher mit Glasur versetzt werden.

Ist die Glasur zu fein gemahlen, so reisst sie leicht beim Trocknen und löst sich dann beim Brennen ab. Die Wirkung des Feuers macht sich zunächst dadurch bemerkbar, dass sich Wasser an den kühleren Stellen condensirt, das aus den Feuergasen saure Bestandteile aufnimmt. Es bilden sich so Sulfate, die die Glasur verändern, oder lösliche Salze der färbenden Oxyde, die sich ausbreiten und die Farben austreten lassen.

Bei höherer Temperatur bilden Mangan und Kobalt Superoxyde, die beim Schmelzen der Glasur Sauerstoff abgeben und Blasen bilden. Grössere Blasen platzen und geben Wülste, kleine Blasen machen „die Eierschäligkeit." — Chromoxyd verflüchtigt sich und macht die Umgebung gelb.

Bei noch höherer Temperatur scheiden reducirende Feuergase aus Bleioxyd metallisches Blei ab, die Glasur wird schwarz gefärbt, „verraucht" Durch oxydirende Flammen wird dann dieses Blei erst nach längerer Zeit wieder oxydirt. Bei nicht bleihaltiger Glasur kann eine Schwarzfärbung durch empyreumatische Stoffe oder Kohle eintreten.

Eierschäligkeit entsteht durch zu frühes Unterbrechen des Glasurbrandes, wenn sich Unebenheiten noch nicht wieder geebnet haben, oder

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auch bei zu starkem Brennen, wenn Schwefelsäure vorhanden ist und bei Zersetzung Blasen bildet. Bei vereinzelten Blasen ist die Glasur „stippig", bei Blasen, die erst beim Erkalten durch Ueberfahren platzen, „krätzig."

Das Verziehen flacher Gegenstände tritt ein, wenn der Scherben früher erweicht als die Glasur; gewöhnlich ist dann der Thonerdegehalt der Glasur zu vermindern. —

G. Wagner, Dingler polyt. Journ. Bd. 246, S. 30, 84, nimmt an, dass die Gläser Gemenge der nachfolgenden Silicate seien:

$K^2(Na^2)O \cdot 6SiO^2$ — $Ca(Ba)O \cdot 2SiO^2$ — Mg (Fe, Mg u. dg.) $O \cdot 5SiO^2$ und $Al^2O^3 \cdot 3SiO^2$; daneben sei noch $K^2(Na^2)O \cdot 5SiO^2$ und $CaO \cdot SiO^2$ zulässig.

In analoger Weise lassen sich die Glasuren zusammengesetzt betrachten. Sie enthalten 9 bis 45 Proc. des vorgenannten Alkalisilicates, 1 bis 18 Proc. CaO, 13 bis 18 Proc. Al^2O^3, der Rest ist SiO^2.

Die Zusammensetzung der Porcellane berechnet Wagner derartig, dass er alle Basen, mit Ausnahme der Thonerde, wie angegeben als Silicat annimmt, so dass sie, wenn keine anderen Bestandteile vorhanden wären, ein klares böhmisches Glas bilden. Der Rest von Al^2O^3 und SiO^2 berechnet er dann als $Al^2O^2 \cdot 2SiO^2$, $Al^2O^3 \cdot 3SiO^3$ und freie SiO^2. Man kann danach als Haupttypen unterscheiden a) Meissener oder Sèvres-Porcellan mit 23 bis 25 Proc. thonerdefreiem Glas und 75 bis 77 Proc. $Al^2O^3 \cdot 2SiO^2$. b) Berliner Porcellan mit 25 Proc. thonerdefreiem Glas, 73 Proc. $Al^2O^3 \cdot 3SiO^2$ und kleinem Ueberschuss an SiO^2 (2 Proc.). c) Böhmische und der grösste Teil der japanischen Porcellane mit 16 bis 38 Proc. thonerdefreiem Glas, 47 bis 68 Proc. $Al^2O^3 \cdot 3SiO^2$ und einem Ueberschuss von SiO^2 bis 36 Proc. Die Sorte a) bezeichnet Wagner als Thon-Porcellan, b) als Glas-Porcellan c) als Kiesel-Porcellan. Die beiden ersten Sorten sind schwerer schmelzbar als die Dritte.

Für Steinzeug findet Verfasser 20 bis 24 Proc. thonerdefreies Glas, 53 bis 58 Proc. $Al^2O^3 \cdot 3SiO^2$, 17 bis 27 Proc. überschüssige SiO^2 d. h. eine der Sorte c des Porcellans ähnliche Mischung. —

Die neueren Porcellane der Königl. Porcellanmanufactur zu Berlin zeigen einen grossen Fortschritt in der Decorirung durch Scharffeuerfarben in der Glasur. Man verfährt dabei so, dass man die verglühten Stücke mit der Glasur überzieht, welche die Grundfarbe liefert, dann die getrocknete Glasurschicht abschabt und hier anders gefärbte Glasuren aufträgt. Die Farben sind besonders blau, grün, braun, rosa und schwarz. Nach dem Brennen werden die einzelnen Flächen durch Goldlinien bestimmter von einander getrennt. In der Masse gefärbte Glasuren werden auch so verwendet, dass zwei Schichten übereinandergelegt werden, von denen die obere im Brande rissig (craquelé) wird, sodass sie die untere Schicht in aderartigen Zeichnungen durchscheinen lässt.

Die Manufactur fabricirt jetzt auch ein nach Seger benanntes Porcellan, welches in seiner Zusammensetzung und Glasur Aehnlichkeit mit dem japanischen hat. Von dem gewöhnlichen Porcellan unterscheidet es

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sich durch geringere Strengflüssigkeit, durch eine grössere Transparenz und seine gelbliche, dem Elfenbein vergleichbare Färbung. Es gestattet nicht nur die Anwendung von mehr färbenden Oxyden in und unter der Glasur, sondern es giebt die Farben in ungleich grösserer Brillanz und Schönheit als altes Berliner Porcellan. Man hat für dieses Porcellan auch ein neues Rot angewendet, welches sich dem bei chinesischen Porcellan durch Kupferoxydul hergestellten im Ton nähert und auch durch Kupfer erzeugt ist. Es lässt sich in völliger Gleichmässigkeit erhalten, während das chinesische Rot stets gefleckt ist. Die Herstellung desselben ist bisher freilich noch sehr dem Zufall unterworfen, weil dieses Rot bei geringen Veränderungen im Brande in ein tiefes Blau, dann in ein ganz helles Blaugrün übergeht. Die Producte erscheinen daher oft in diesen beiden Farben oder in den drei Farben, wobei dann auch manchmal sich wundervolle Uebergänge zeigen. Der geringere Schmelzpunkt der Glasur des Seger-Porcellans gestattet auch bei diesem wie bei dem chinesischen und japanischen das Aufschmelzen durchsichtiger, als Relief aufgetragener Emaillen.

Es werden neuerdings von der Manufactur sehr schön verzierte Fliesen in altem Porcellan und Seger-Porcellan hergestellt, eine Technik, die dadurch sehr interessant ist, dass es bisher nicht gelungen war, Porcellan in solcher Dicke (1 cm) durch und durch gleichmässig zu brennen. Es sind die Fliesen aus Seger-Porcellan besonders schön, dabei ist der Preis nicht höher, als der feinster Minton'scher Fliesen.

Die Firma Poduschka in Krumnussbaum liefert in neuerer Zeit Aufsehen erregende Scharffeuerdecorationen in blau, grün und rot (chinesisches Rot). (Frauberger, Thonind.-Ztg. 1882 S. 200.)

Zur Herstellung einer grauen Glasur empfiehlt die Thonind. Ztg. 1882 S. 240, feines Zerreiben von 1 g Iridiumsesquioxyd oder 1 g Platinmoor oder 2·28 g Platinsalmiak mit 1 kg weissem Email. Die Mischung wird eingetrocknet (bei Anwendung von Platinsalmiak, ohne das Wasser abzugiessen) gröblich zerstossen und im Ofen gefrittet. Die erhaltene graue Fritte wird wiederum sehr fein gemahlen und dann mit soviel weisser Glasur versetzt, bis die durch eine Brennprobe zu ermittelnde graue Nüance erreicht wird. Das schönste und reinste Grau wird durch Iridiumsesquioxyd erhalten.

Zur Imprägnirung von unglasirten Thonwaaren, besonders Pflanzenetiquetten, um darauf mit Tinte zu schreiben, werden von Wiencke in Hamburg (D. P. 22313 vom 5. September 1882) Molken benutzt, die dadurch erhalten werden, dass man abgerahmter Milch ein wenig Säure hinzusetzt und den Niederschlag abfiltrirt. Die aus weissem Pfeifenthon hergestellten Tafeln werden mit dem Filtrat imprägnirt und getrocknet. Man kann dann darauf wie auf schwach geleimtem Papier schreiben.

Feix in Albrechtsdorf (D. P. 22718 vom 13. December 1882) überzieht zum Emailliren von keramischen Producten oder Glas dieselben zunächst mit einer die Elektricität leitenden Schicht, indem er dieselben z. B. mit Lösungen von Platinchlorid oder Silbernitrat bestreicht und brennt. Er

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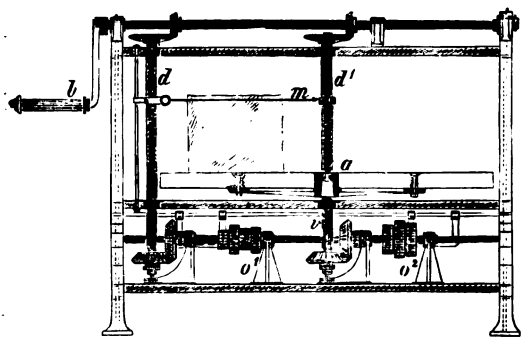
decorirt dann mit Emailmasse in gewünschter Weise, brennt das Email ein und überzieht sodann die Oberfläche elektrolytisch mit dem Metall. Der galvanische Ueberzug lässt das Email frei und befestigt dasselbe dadurch, dass es etwas über die Umrisse desselben hinauswächst. Durch Vergolden, Versilbern, Färben, Poliren, Platiniren etc. können sodann auf den Metallflächen des Gegenstandes die verschiedensten Effecte hervorgerufen werden.

Formgebung. — Die Maschinenfabrik Regensburg, G. A. Schoepf & Co. (D. P. 21402 vom 23. April 1882) hat die bekannte Maschine zum Schneiden von Blättern aus Massekuchen in einigen Punkten verbessert. Die Massekuchen werden auf dem sich drehenden Tische *a* durch den allmälig herabrückenden Schneidedraht *m* in Blätter geschnitten. Von der Kurbel *b* aus werden die Spindel *d* und die centrale Spindel *d'* zur Verschiebung des Drahtes mit gleicher Geschwindigkeit angetrieben, während die von *d'* unabhängige Welle *v* der Tellerscheibe von *d* aus gedreht wird und durch Verschieben der Rädersätze o^1 und o^2 verschiedene Geschwindigkeiten erhält. Diesen Geschwindigkeiten entsprechend lassen sich verschiedene Blätterdicken herstellen.

Fig. 77.



Im D. P. 19230 vom 13. October 1881 von Willett in Burslem sind verschiedene automatisch wirkende Maschinen zum Drehen von Töpferwaaren beschrieben. Ein um eine verticale Achse *b* drehbarer Tisch *a* (Fig. 78) ist mit Aussparungen zur Aufnahme der Formen *c* versehen und erhält durch Hand eine intermittirende Bewegung, wodurch die Formen nach einander unter die arbeitenden Werkzeuge *d d'* gebracht werden. Die Werkzeuge *d* werden an dem unteren Teile verticaler Wellen $e\,e^1$ angebracht, welche neben einer rotirenden auch eine auf- und abgehende Bewegung erhalten. Diese Bewegungen werden denselben durch in Nuten geführte rotirende Naben $h\,h^1$ und andererseits durch den Contact mit excentrischen, auf einer horizontalen Welle sitzenden Scheiben *i* ertheilt. Mit den rotirenden, gleichzeitig auf- und abgehenden Werkzeugen wird die Innen- oder Aussenseite der Thon- oder Steingutwaaren hergestellt. Anstatt dass das Werkzeug rotirt, kann es auch nur eine auf- und abgehende Bewegung erhalten und dann in Verbindung mit rotirenden Formen *D* verwendet werden. Diese Modification ist in der Fig. 79 dargestellt. Will man hierbei gebauchte Gegenstände im Innern ausdrehen, so wird das Werkzeug *M* excen-

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trisch an der Spindel *L* angebracht. Die Spindel macht dann eine Teildrehung um ihre Achse, wenn sie niedergeht, indem spiralförmig oder anders

Fig. 78.

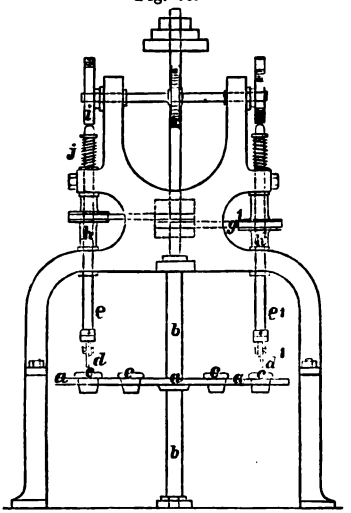
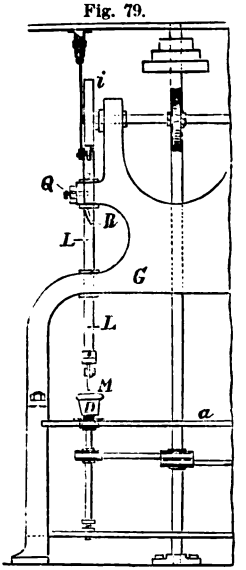
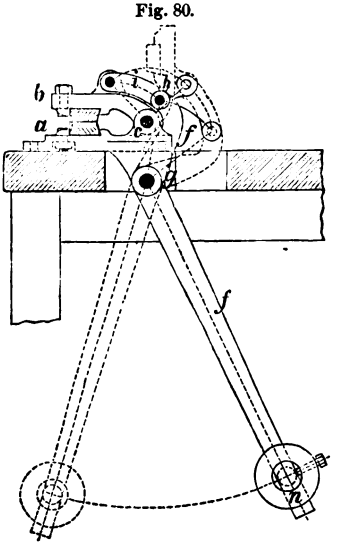


Fig. 79.



passend geformte Nuten *R* für die Schrauben *Q* in die Spindel eingearbeitet sind. Es ist dann eine dritte Maschine beschrieben, bei der ebenfalls die Form rotirt, während das Werkzeug still steht; letzteres sitzt an einem Ende eines zweiarmigen Hebels, wobei die automatische Hebung und Senkung des Werzeuges durch eine auf das andere Ende des Hebels wirkende excentrische Scheibe bewirkt wird.

Fig. 80.



Eine, wie es scheint, praktische Pendelpresse für Fussbetrieb zur Herstellung kleiner Porcellangegenstände hat Bockhacker in Berlin (D. P. 19008 vom 30. November 1881) erfunden. Der Formenoberteil *b* ist mit dem Unterteil *a* durch Scharnier *c* und durch ein Mittelstück *i* nebst Scharnier *h* derartig mit dem um *g* drehbaren Fusspendel *f* verbunden, dass sich dieses Scharnier beim Zuklappen von *b* dem Drehpunkt *c* möglichst nähert. Hierdurch erfolgt das Zuklappen, auch bei gleichförmiger Bewegung des Trittstabes *n*, mit starker Beschleunigung.

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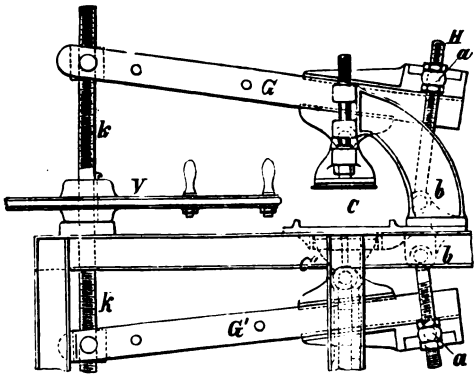
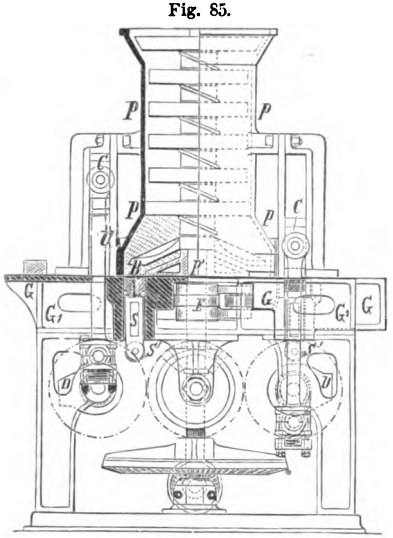
Fig. 84.



Schrauben H verstellbar sind, geschieht durch Hebel G und G^1. Diese drehen sich und werden durch Drehung einer mit Rechts- und Linksgewinde versehenen Spindel K gemeinschaftlich bewegt. Spindel K wird mittelst des Handrades V gedreht.

Walton in Bournemouth hat eine neue Ziegelstreichmaschine angegeben. (D. P. 19007 vom 23. November 1881.) Die Formen A sind in zwei mit einander verbundenen Schlitten G angeordnet, welche durch den mit Frictionsrolle versehenen, von Welle P^1 getriebenen Daumen E in den Führungen G' in der Art hin- und herbewegt werden, dass die beiden Formen A in den Endstellungen je unter einer Ausströmungsöffnung B des Thonschneiders P zur Füllung und dann unter einem Stempel C zum Nachpressen des Inhalts einige Zeit verharren.

Fig. 85.



Der Formboden S ist mit der Frictionsrolle S' versehen. Nach der Pressung wird S' von dem eigentümlich geformten, rotirenden Daumen zunächst gehoben und dann auch bei Verschiebung der Form von C nach B so lange hochgehalten, bis sich die Form um eine Steinbreite verschoben hat. Der so ausgestossene und im Niveau des Tisches gehaltene Stein wird durch die Streichbretter U zur Seite geschoben, so dass er bei Rückkehr von G bequem abgenommen werden kann.

Eine Ziegelstreichmaschine ist von Munkelt in Breslau (D. P. 20737 vom 26. Mai 1882) construirt.

Nach der vorteilhaften Anwendung, die hydraulische Pressen zur Herstellung von Cementplatten etc. gefunden haben, hat man sie auch für Ziegelfabrikation anzuwenden gesucht. Hierfür hat Sendtner in

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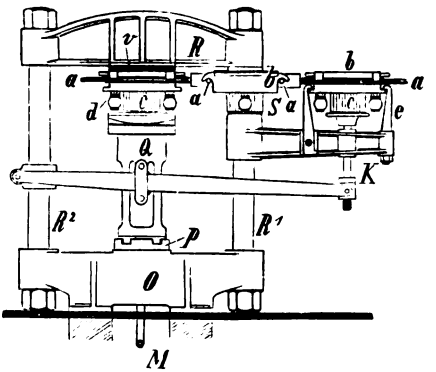
München (D. P. 19213 vom 21. December 1881) eine Construction angegeben, bei welcher, nachdem der Arbeiter die Presse in Thätigkeit gesetzt hat, der Stempel den grössten Teil seines Weges mit geringerem Druck herabgeht und erst im letzten Moment den vollen Druck erhält. Zwei Pumpen speisen einen Niederdruck- und einen Hochdruckaccumulator, welche an einen Ventilkasten angeschlossen sind. Drei in diesem befindliche Ventile stellen die Verbindung der Presse mit dem Niederdruckaccumulator, dem Hochdruckaccumulator und drittens mit dem Ablaufrohr her; sie werden nach Einrückung einer Kuppelung automatisch nach einander geöffnet. Das den Ventilkasten mit der Presse verbindende Rohr *M* mündet in den hohlen, an der Grundplatte *O* befestigten Kolben *P*, über den der Cylinder *Q* gestülpt ist. Die Traverse *R*, welche die Oberform *v* trägt, ist mit der Grundplatte durch zwei Säulen $R^1 R^2$ verbunden. Zum Pressen von Steinen und Platten ist an R^1 ein vierarmiger Stern *S* drehbar; jeder Arm trägt eine Gabel *a*, in welche der Rahmen *b* der Unterform eingehängt ist. Der Formenrahmen trägt vier Gummipuffer *d*. Diese werden, sobald der Formboden *c* nach oben gedrückt wird, zusammengedrückt, wodurch der Formrahmen *b* fest gegen die Oberform *v* gepresst wird. Beim Ausstossen wird der Rahmen *b* mittelst der Klauen *e* festgehakt, so dass der von *Q* getriebene Ausstossstempel *K* den Stein aus dem Rahmen herausstossen kann. Zum Pressen von Falzziegeln wendet man statt des Sternes *S* vier von einander unabhängige Gabeln an, von denen zwei um R_1 und zwei um R^2 drehbar sind. Die Unterformen ruhen mit zwei Paar Zapfen frei auf den Gabeln und werden zum Ablösen des gepressten Falzziegels umgeklappt.

Fig. 86.



Strangpressen. — Ueber die Stärkeverhältnisse von Thonschneidepressen zeitigt eine Controverse zwischen Schlickeysen, Groke (Nienburger Eisengiesserei, vorm. Hertel & Co.) und einem Herrn X (Töpfer- u. Ziegler-Ztg. [No. 14], Thonind.-Ztg. 1882, S. 176, 209, 219, 229) sehr verschiedene Ansichten. Im allgemeinen wird eine möglichst ausgiebige Verwendung von Stahl empfohlen. Nach X sind besonders auch Walzen aus Tiegelstahl ($^3/_4$ Zoll Wandstärke) empfehlenswerter als die meist gebräuchlichen Hartgusswalzen. Bezugsquellen für Maschinenteile aus Stahl siehe Thonind.-Ztg. S. 248, 258, 266.

Das Mundstück von Ziegel- und besonders Torfpressen versieht Pieau in München (D. P. 19973 vom 6. April 1882) mit einer leicht aufspringenden oberen Wand.

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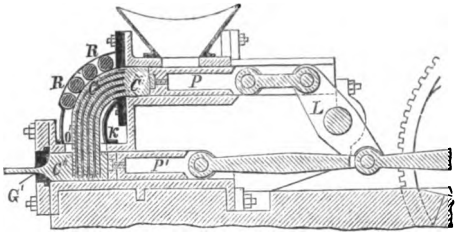
Eine Vereinigung einer Kolbenpresse mit einer eigentümlichen Mischvorrichtung für den zu pressenden Thon hat Cancalon in Roanne (D. P. 19804 vom 12. Februar 1882) erdacht. Der Thon wird aus dem Raume C mittelst des Kolbens P durch eine durchlochte Platte gepresst. Die so erhaltenen Thonstränge werden in dem Raume $O^1 K$ durch die Rollen R abgebogen und dann im Raume C' durch den Kolben P^1 wieder zusammengepresst und durch Oeffnung G^1 hinausgedrückt. Die Kolben P und P^1 sind mit einem Balancier L dergestalt verbunden, dass sie abwechselnd vorgehen und also in C'' entweder oben Thon hinein- oder unten Thon herausgepresst wird.

Fig. 87.



Eine Vorrichtung zum bequemen und schnellen Auswechseln der vollbesetzten Abtragebretter durch leere ist von Mänicke in Kriebitzsch (D. P. 19796 vom 22. Januar 1882) beschrieben.

V. Dachziegel, Falzziegel, Verblendplatten u. s. w.

Neue Formen von Dachziegeln sind angegeben von Kerll in Freiburg (Baden), s. D. P. 17589 vom 25. August 1881, und von Vuillaume in Blanquefort. (D. P. 17914 vom 18. October 1881.)

Ludowici in Ludwigshafen (D. P. 16757 vom 7. Mai 1881 und D. P. 17940 vom 4. September 1881 hat an Falzziegeln unten Rippen angebracht, mittelst welcher sie beim Transport und Lagern fest aufeinander gepackt werden können. Die oberste Rippe dient zum Aufhängen. Eine besondere Einrichtung der Falze soll das Eindringen des Wassers verhindern. — J. Mönch & Co. in Gerstungen (D. P. 19157 vom 3. December 1881) construiren Falzziegel, die eine möglichst glatte Dachfläche bilden sollen.

Verblendplatten als Ersatz der für Benagelung dienenden Schiefer sind von J. Mönch & Co. in Gerstungen (D. P. 16823 vom 27. Juli 1881), und in einer kleinen Abänderung von Demmer in Eisenach (D. P. 21053 vom 9. April 1882) construirt.

Nach O. Bock (Thonind.-Ztg. 1882 S. 1) hat die Falzziegelindustrie in Deutschland seit 5 Jahren einen ausserordentlichen Aufschwung genommen. Ein Uebelstand bei Falzziegeln ist, dass die Horizontalfugen gegen Staubschnee nicht ganz dicht sind. Er beseitigt diesen Uebelstand dadurch, dass er auf jede Reihe Falzziegel eine Schnur von Cocosfasern parallel mit den Latten legt und die nächste Reihe Ziegel so darüber deckt, dass sie das Cocosgarn bedecken und festklemmen. — Er empfiehlt ferner ein nicht zu grosses Format für die Falzziegel, zweckmässig $^1/_{21}$ qm Deckfläche.

Nach demselben (Thonind.-Ztg. S. 92) haben sich besonders die Boulet-

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schen Falzziegel bewährt. Sie lassen sich leichter in Metallformen herstellen und im Ofen auf hoher Kante brennen, wodurch ein Verziehen fast ausgeschlossen ist. Für den Ofen (Ringofen) empfiehlt es sich, directe Luftzuführungscanäle zur Sohle anzulegen. Die unteren Schichten werden entlastet, indem man Nischen aus Mauersteinen aufbaut und hierin die Falzziegel einstellt.

Nach Gilcher (Thonind.-Ztg. 1882 S. 74) empfiehlt sich für Falzziegel die Anwendung von Gypsformen viel mehr als von Metallformen. Mit je 2 unteren und je 2 oberen eingegypsten Arbeitsformen stellt er auf einer Excenterdruckpresse 1 600 bis 2 000 Ziegel her. Spindelpressen wirken auf Gypsformen nachteiliger als Excenterpressen.

Die Firma Ramdohr, Blumenthal & Co. in Halle a. S. empfiehlt nach Thonind.-Ztg. 1882, S. 92 Magnesiacement (aus Magnesia und Chlormagnesium) zur Herstellung der Formen für Falzziegelpressen; das Kg würde 12 Pfennig kosten.

Nach Rasch, Thonind.-Ztg. 1882, S. 440 kann jedoch der Magnesiacement nicht vorteilhaft verwendet werden, weil er zu dicht ist. Rasch wollte ihm poröse Beimengungen geben, Sägespäne, Torffaser; dadurch wurde aber die Masse wenig fest.

H. Bolze (Thonind.-Ztg. 1882, S. 122) empfiehlt zum Einfetten der Metallformen für Falzziegel eine Mischung aus 4 Tln. Petroleum und 1 Tl. Baumöl. Der Thon muss möglichst steif zur Verarbeitung kommen. — Moritz (daselbst) wendet eine Mischung von 2 Tln. Petroleum und 1 Tl. Talg an, womit er die Formen und das Thonblatt (Galette) bestreicht. — Schuster (das. S. 160) benutzt eine Wasserglaslösung.

Eberding beschreibt in Thonind.-Ztg. 1882, S. 211 eine Falzziegelfabrik. Das Rohmaterial, ein Gemenge von gelblichem und bläulichem Lehm und einem grauen fetten Thon, passirt ein Doppelwalzwerk und einen Thonschneider, der ein Band von 300 mm Breite und 200 mm Höhe liefert. Dies wird in einer Walzenpresse in einen sehr steifen Strang von 250 mm Breite und 20 mm Dicke verwandelt, der in Blätter von 300 mm Länge geteilt wird. Die Blätter werden auf der unteren Seite mit einer Mischung von Petroleum und Rüböl bestrichen und auf einer Spindelpresse, die mit Frictionsscheiben und selbstthätiger Ausrückung arbeitet, in eisernen Formen gepresst. Die Presse liefert in 10 Stunden 4 500 Falzziegel und gebraucht ca. 2 Pferdekraft. Die geputzten Ziegel gelangen (zu 200) auf ein Trockengerüst, das mittelst eines untergeschobenen Wagens fahrbar ist. Der Trockenraum wird mittelst Blechröhren durch abgehenden Dampf geheizt. Der Raum ist von Canälen durchzogen, in welche die Wagen hineingeschoben werden, wobei das Gerüst die seitlichen Ränder des Canals überragt. Durch einen am Wagen befindlichen Mechanismus wird sodann das Gerüst gesenkt, worauf der Wagen fortgezogen wird. Nach dem Trocknen werden die Gerüste durch die Wagen nach dem Ofen gebracht. Die Ziegel werden meist schiefergrau gedämpft.

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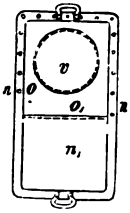
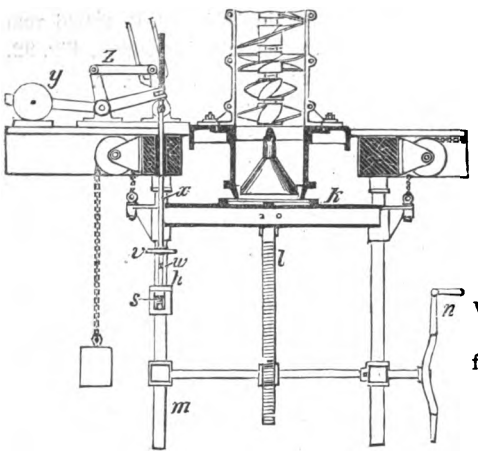
und unten offenen Ringe *k* und dem Kern *i*, welcher bis über Ring *k* greift und daran durch Wirbel befestigt werden kann. Der Kern *i* kann mittelst der Spindel *q* und des Handrades *r* gehoben und gesenkt werden. Die gepresste Kapsel wird von dem übrigen Thon in Höhe *o* durch den Abschneider (Fig. 93) abgeschnitten. Ein Rahmen verschiebt sich in zwei Führungen *n*, welche von der Presse nach dem daneben befindlichen Ausstosstisch *t* führen. In *n* ist der Raum n_1 freigelassen und ein Messer *o* angeordnet, welches bei o_1 seine schneidende Kante hat. Aus der Fläche des Messers *o* ist ein der Grundfläche der Kapsel gleiches kreisförmiges Stück herausgenommen und hier der Einsatz *v* eingepasst. Bei dem Formen steht der Messerrahmen *n* derartig, dass die Form *C* in dem freien Raum n_1 sich befindet. Nach dem Formen werden *k* und *i* etwas angehoben, und dann wird das Messer nach vorn gezogen; die Kapsel ist abgeschnitten und steht auf dem Einsatz *v*. Nun wird *i* aus der Kapsel herausgezogen und das Messer zurückgeschoben, wobei die noch im Formenring *k* befindliche Kapsel mitgenommen und über eine Ausstossvorrichtung (im Tisch *t*) gebracht wird. Die Kapsel wird dann auf dem Blech *v* ausgestossen und mit demselben abgehoben.

Fig. 94.



Bei der Maschine von Gebrüder Pfeiffer in Kaiserslautern (D. P. 21693 vom 1. Juli 1882, Fig. 95) wird der Kapselboden auf Tisch *k* gelegt und durch Drehen der auf Stange *l* bezw. den Tisch *k* wirkenden Kurbel *n* fest gegen die Mundstücköffnung gepresst. Dann setzt man den Thonschneider in Gang, indem man an dem Handrädchen *v* die Stange *x* herunter zieht, bis eine an Säule *m* befestigte Feder *s* in die Auskerbung *w* eingreift; hierbei wird der Riemenwechsler *z* gedreht, der Riemen auf die feste Scheibe geschoben und die Thonschneidewelle gedreht. Es tritt nun die röhrenförmige Seitenwandung der Kapsel aus, die auf dem ausbalancirten Tisch *k* herabsinkt, bis Tisch *k* an eine Klinke *h* stösst und dadurch die oben genannte Feder *s* auslöst. Durch Gewicht *y* wird Stange *x* gehoben, der Riemenwechsler *z* gedreht, der Riemen auf die Leerscheibe geschoben und der Thonschneider ausser Thätigkeit gesetzt. Die Kapsel wird nun mit Draht abgeschnitten. Die Kapseln werden auf diese Weise gleich hoch; die Höhe wird durch Einstellen von *h* regulirt.

Fig. 95.



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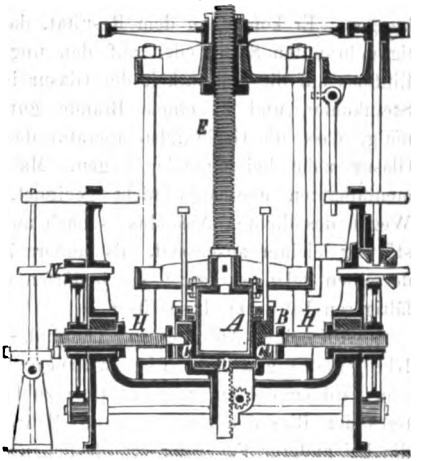
Die Schraubenpresse von Pothier in Paris (D. P. 20732 vom 2. Mai 1882, Fig. 96) hat drei Spindeln, *E*, *H*, *H*; die verticale Spindel *E* bewegt den Stempel *A* nach unten, während zwei horizontale Spindeln *H* die beiden Seitenteile *C* und C^1 der Form zusammenschieben, wobei diese von der nach oben verschiebbaren Kappe *B*, welche zugleich den Formendeckel bildet, seitlich umfasst werden. Der Boden *D* der Form ist durch Zahnstange und Trieb beweglich. Die Umsteuerung der Spindeln erfolgt automatisch. Die Spindel *E* wird von Welle N^1 (rechts *N* gegenüber) aus angetrieben, während die Spindeln *HH* von Welle *N* aus bewegt werden.

Fig. 96.



Glasirte Ziegel. — Eine Commission des Hannoverschen Architekten- und Ingenieurvereins, bestehend aus den Herren Debo, Frühling, Hecht, Haase, Hehl, hat für Glasirte Ziegel folgende Thesen aufgestellt. 1. Der zu glasirende Ziegel muss an und für sich durchaus wetterbeständig und völlig frei von unzerteilten Kalkteilchen sein. 2. Die Glasurmischung ist sehr dünn aufzutragen und dem Scherben derartig anzupassen, dass der Ueberzug mindestens frei von mit unbewaffnetem Auge wahrnehmbaren Rissen wird. Die Glasur ist aber als vollkommen nur dann zu betrachten, wenn solche auch frei von den erst mit bewaffnetem Auge wahrnehmbaren Haarrissen ist. 3. Gegenüber diesen Anforderungen an die Güte des Scherbens und die Glasurdecke müssen alle Wünsche bezüglich der Nüancirung und Gleichmässigkeit der Glasurfarbe zurückstehen. — Dem interessanten Bericht entnehmen wir noch, dass im dortigen Bezirk für bessere Bauten zur Anwendung kommende Glasuren zu 50—70 Proc. frei von mit unbewaffnetem Auge erkennbaren Haarrissen und zu 3 Proc. auch frei von mit bewaffnetem Auge erkennbaren sind. Die Glasuren werden auf den gargebrannten Ziegel aufgetragen, nachdem derselbe sehr sorgfältig vom Staub befreit ist, und werden dann meistens in einem kleinen, ausschliesslich dazu verwendeten Ofen nach Art der Hase'schen Construction unter Verwendung von Holzfeuerung gebrannt. Als Glasur werden Mischungen von 1 bis 2 Teilen Bleioxyd mit 1 Tl. Sand verwendet; für Grün, durch Kupferhammerschlag, der geringste Zusatz von Glätte; für Hellbraun bis Schwarz Braunstein; für Farblos 4 Tle. Glätte und 3 Tle. Sand. Diese Farben kommen auch bei mittelalterlichen Bauwerken vor neben braunschwarzen Köpfen, die wahrscheinlich durch Klinkerung erzeugt sind. — Der Ziegel muss möglichst hart

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gebrannt sein; es eignet sich dazu ein Thon, der in Folge zerteilten Kalks zur leichten Sinterung geneigt ist (Thonind.-Ztg. 1882, S. 349).

Zu diesem Bericht macht Rühne, das. S. 368, 378, 388 einige Bemerkungen. Er kommt zu dem Resultat, dass die Auftrageart, ob auf den fertig gebrannten Stein oder auf den ungebrannten Stein, ohne wesentlichen Einfluss auf die Haltbarkeit der Glasur ist. Nach ihm kann man auch mit Steinkohlen und in einem Brande gute Glasuren erzielen. Es ist hierfür nötig, dass die Garbrandstemperatur des Ziegels und der Schmelzpunkt der Glasur nahe bei einander liegen. Maschinenziegel hält Rühne für Monumentalbauten überhaupt nicht geeignet, besonders nicht als Glasurziegel. Wegen des dichten Abschlusses nach aussen sind die Glasurziegel der Zerstörung leichter ausgesetzt, als andere Ziegel, falls das Wasser ins Innere derselben gelangen kann; sie bedürfen daher auch einer entsprechend sorgfältigeren baulichen Disposition.

Auf eine Anfrage in Thonind.-Ztg. 1882, S. 344, wie sich mit Bleiglasur glasirte Thonwaaren im Ringofen am besten brennen lassen, wird empfohlen, nur mit Holz zu brennen. Man kann dann ohne weiteres den Ringofen benutzen; die Mehrkosten würden voraussichtlich durch die bei anderer Feuerung erforderlichen Einbauten compensirt werden.

Um Steine in einem Brande (bei ca. 1000° C.) mit einer Bleiglasur zu versehen, trägt Kürbs (Thonind.-Ztg. 1882, S. 74) auf den rohen trockenen Scherben ein Gemenge von Bleioxyd mit Thon und Feldspath auf. Für zartere Farben wendet er statt Thon Kaolin an; auch ist hier für Grün Kupferoxyd nicht verwendbar, wohl aber Chromoxyd.

Nach Thonind.-Ztg. 1882, S. 46 vollziehen sich beim Graudämpfen zwei verschiedenartige Processe. Es wird einerseits durch reducirende Gase im Thone vorhandenes Eisenoxyd reducirt, andererseits aber wird aus den Gasen Kohlenstoff (Graphit) abgeschieden und in den Poren der Thonwaaren abgelagert. Dem letzteren Falle entsprechend kann man z. B. auch den eisenärmsten Thon (Kaolin) ganz schwarz dämpfen. Von einem Falzziegel, der einen schön matten Glanz hatte, konnte man mit dem Messer eine glänzende Haut ablösen, die ohne Aschenrückstand verbrannte, also Graphit war; unter jener Schicht lag der nicht glänzende, schwarze Scherben. Für die Ausscheidung glänzenden Graphits wird die Temperatur und die Natur des Dämpfmaterials verschieden günstig sein, andererseits wird sie durch eine möglichst glatte, dichte und polirte Oberfläche befördert.

Während man sonst meist feste oder flüssige Körper, wie Erlenholz, Steinkohlen, mit Teer getränkte Sägespäne, Harzextracte, zum Graudämpfen in den Ofen brachte, hat man neuerdings verschiedentlich Heizgas benutzt oder auch Leuchtgas vorgeschlagen (s. d. J. IV. S. 94). Es hat nun Otto Bock in Cassel (D. P. 19791 v. 30. December 1881) einen Blaudämpfofen, Fig. 97, angegeben, bei dem der Einsatz zunächst mittelst directer Feuerung von *C* aus halbgar gebrannt wird, während das Garbrennen und Dämpfen mittelst Generatorgases bewirkt wird. Es ist demnach die Feuerung *C* für festes

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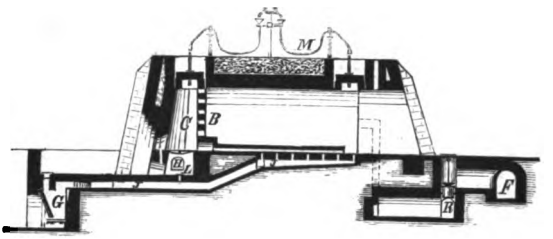
Brennmaterial vorgesehen; der Feuerraum ist von dem Brennraum durch eine Heizwand *B* getrennt. Andererseits ist neben dem Ofen ein Generator *G* angeordnet, von dem aus die Canäle *J* unter den Brennraum führen. Das Gas strömt unten in den Ofen, entzündet sich und verbrennt mittelst Luft, die durch den Rost der Feuerung *C* zuströmt.

Fig. 97.



Zur Anwärmung der Luft unterhält man auf dem Rost ein kleines Feuer. So brennt man die Waare gar. Dann verschliesst man alle Oeffnungen und auch die Verbindung mit dem Schornsteinfuchs *F*. Man füllt den Generator bis oben hin mit Kohle und führt die Gase durch Düse *L* in den Ofen. Nach beendetem Graudämpfen lässt man durch den verstellbaren Wasserverschluss *M* Wasser in Tropfen einfliessen, dessen Dampf den Ofen kühlen und das Eindringen der Luft verhindern soll. — Die abgehende Wärme der einen Kammer kann in den benachbarten ausgenutzt werden, indem man mittelst der Kanäle *R* und *H* die Feuergase in die neu besetzte Kammer leitet.

VI. Oefen.

Mendheim baut jetzt nach einem Vortrage im D. Verein f. Fabr. von Ziegeln (Thonind.-Ztg. 1882, S. 90 und S. 191) periodische Oefen mit Halbgasfeuerung und Regeneratoren. Die Feuerungen liegen in den Ofenwänden und werden zunächst als directe zur Vorfeuerung, dann als Gasfeuerung zum Hauptbrand benutzt; die Flamme hat dabei am Boden der Feuerung ihren Abzug. Die verwendeten Regeneratoren (System Mendheim & Haupt) sind folgendermaassen construirt: Grosse Steine von 50 cm im Quadrat Grundfläche sind in Säulen aufgeschichtet, und durch die Steine sind Röhren gebohrt, sowohl in verticaler, wie in horizontaler Richtung, wodurch Canäle für die abziehenden Feuergase und für Luft entstehen, die im Gegenstrome aneinander vorbei geleitet werden.

F. Steinmann in Dresden giebt (Thonind:-Ztg. 1882, S. 19) Erfahrungen über Knallgasbildungen und Explosionserscheinungen bei Gasfeuerungsanlagen.

Bestimmung hoher Temperaturen im Ringofen mittelst Legirungen edler Metalle s. Thonind.-Ztg. 1882, S. 248.

Einzelöfen. — Von Arnold in Bischweiler (D. P. 20229 vom 9. Februar 1882) werden in dem deutschen Ziegelofen, um die Verbrennungsproducte in halber Höhe des Ofens abzuführen, und zur besseren Verteilung der Flamme in den vier Ecken Schornsteine angelegt, Fig. 98, welche bei *a a'* etwa in halber Höhe des Ofens innen frei münden. Die Steine werden bis zu

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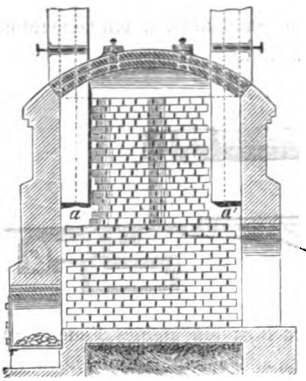
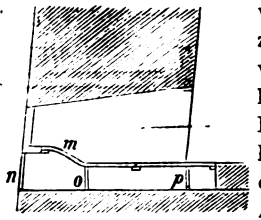
Fig. 98.



dieser Höhe wie gewöhnlich eingesetzt, von da ab aber so, dass erstens an den vier Seiten des quadratischen Ofens freie Räume, zweitens zwei diagonal verlaufende Canäle ausgespart werden.

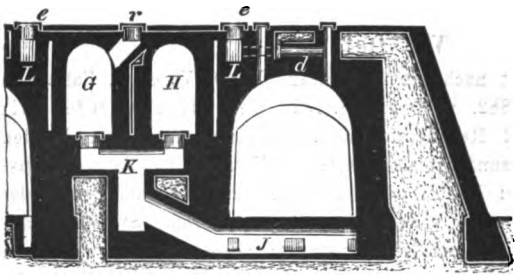
Fig. 99.



Pritsch in Rheydt (D. P. 19583 vom 3. Jan. 1882) verwendet bei Feldziegelöfen einen vorn nach oben gekrümmten Rost *m*, Fig. 99, bei dem der Luftzutritt durch eine Anzahl in den Aschenfall eingesetzter Zugtüren oder beweglicher Wände *n o p* regulirt werden kann. *n* ist die vordere, *o* die mittlere, *p* die hintere Zugtür im Aschenfall.

Continuirliche Oefen. — Jahn und Schüler in Werbig (D. P. 20841 vom 17. Februar 1882) haben einen Ringofen zum Brennen von Dachziegeln u. s. w. mit Anlage zum Schmauchen von unten nach oben und umgekehrt angegeben. Bei demselben liegen in der Mittelwand die beiden geradlinig verlaufenden (verkürzten) Canäle *G* und *H* neben einander; *G* ist der nach dem Schornstein führende Rauchsammler, *H* der Hitzeleiter, welcher dazu dient warme Luft aus einer sich abkühlenden Kammer in eine frisch besetzte Kammer zum Ausschmauchen derselben zu leiten. Die Canäle *G* und *H* communiciren durch Doppelschächte *K* mit Quercanälen *J*, die ihrerseits an eine grössere Zahl von Oeffnungen im Boden der Kammer angeschlossen sind. Ein ringförmiger Schmauchcanal *L* steht durch Thonröhren *d* mit den Schürlöchern in der Decke bezw. mit der Kammerdecke selbst in Verbindung; durch zwischen *e* und *r* aufgesetzte Ueberführungsrohre wird *L* an geeigneter Stelle mit dem Rauchsammler *G* verbunden.

Fig. 100.



Während nun der Brennprocess in diesem Ringofen wie gewöhnlich geführt wird, gestattet diese Construction ein doppeltes Schmauchen. Es wird zuerst mit aus der kühlenden Kammer herrührender Luft von unten nach oben geschmaucht, indem man die Luft durch *JKHKJ* in die neu eingesetzte Kammer, und die Schmauchgase durch *L* nach *G* leitet. Dann

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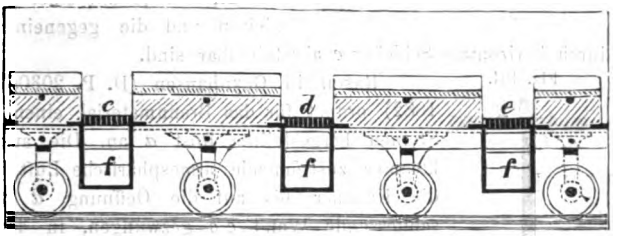
wird von oben nach unten geschmaucht. Man zündet ein Schmauchfeuer über *e* bezw. *L* an und leitet die Gase desselben durch *L* in die Kammer oben ein, die Schmauchgase aber durch *JK* und *G* in den Schornstein.

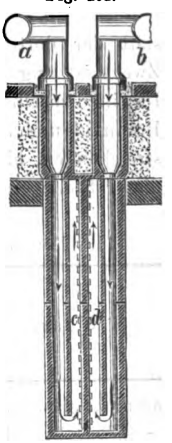
Theodor Schlegel in Düsseldorf hat Neuerungen an Brennwagen für Canalöfen und in der Befeuerung dieser Oefen angebracht (D. P. 22957 vom 29. August 1882). Der Brennwagen ist aus Eisen und feuerfestem Stein construirt und enthält die vollständige Feuerungsanlage. Die Feuerungen liegen vertieft im Brennwagen, wodurch eine directe Berührung des Heizmaterials mit der zu brennenden Waare verhindert wird. Die Feuerungsanlage besteht aus den Rostflächen *c d* und *e* und aus dem darunter befindlichen Aschenkasten *f*; beide Teile, Roste und Aschenkasten, sind mit einer eisernen Klappe geschlossen. Diese Klappen werden geöffnet, sobald der Brennwagen in den mittleren Raum des Canals tritt. Hier befindet sich ein kleiner Anbau, von dem aus die Beheizung geschieht. Hier sind drei Thüren, die den drei Feuerungen des Wagens entsprechen. Gelangt der Wagen hierhin, so werden die Aschenfälle *f* geöffnet, der Wageninhalt wird gebrannt, dann wird *f* wieder geschlossen und die Wagenreihe um einen Wagen verschoben.

Fig. 101.



Um im Gasringofen bezw. Gaskammerofen möglichst hohe Temperaturen zu erzielen, werden von Dannenberg in Görlitz (D. P. 19017 vom 7. October 1881, Zusatz zu 17654)*) Brenner angewendet, die zwei Canalsysteme besitzen. In das eine System wird bei *a* das Gas, in das andere bei *b* die (event. in anderen Kammern bereits erhitzte) Speiseluft eingeführt. Die Gase durchströmen die glühenden Brennercanäle, erhitzen sich hierbei möglichst stark und strömen dann aus den aufeinander treffenden Oeffnungen *c* und *d* aus, um als heisse Flamme in den Ofen zu treten.

Fig. 102.



Bei dem continuirlichen Kammerofen von Dunnachie in Lanark (D. P. 19522 vom 24. November 1881) strömt das Gas in Canal *a* unter die Ofensohle, Fig. 103. Um die dem Kammerzuge folgende Verbrennungsluft mit dem Gase innig zu mischen, wird sie bei *b* unter die Zwischenwand der Kammern geleitet; sie gelangt in den Canal *B*, dann in den darüber ange-

*) Techn.-chem. Jahrb. 1883, S. 90.

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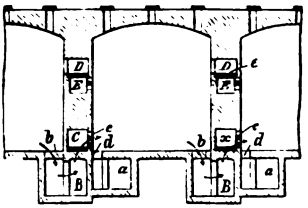
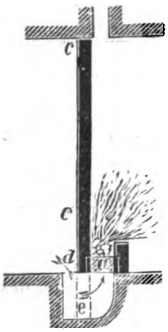
Fig. 103.



ordneten Canal *C* und strömt durch die Schlitze *c* aus, wo sie mit dem aus den Schlitzen *d* austretenden Gas zusammentrifft. Der Luftzug ist durch horizontale Schieber *x* zu reguliren. Um heisse Luft in den oberen Teil des Ofens einzulassen, befinden sich in der Zwischenwand Zwillingszüge *D* und *E*, die je mit einer Kammer communiciren und die gegeneinander wiederum durch horizontale Schieber *e* abschliessbar sind.

Fig. 104.



Rasch in Oeynhausen (D. P. 20306 vom 12. März 1882) ordnet für das Brennmaterial einen aus feuerfesten Steinen hergestellten Rost *a* an. Die aus der Nachbarkammer zuströmende atmosphärische Luft wird durch die die Kammer bis auf die Oeffnung *d* vollständig abschliessende Wand *c c* gezwungen, in der Richtung der Pfeile den Aschenfall *e* und der Rost *a* zu passiren.

A. und F. Fach in Wiesbaden (D. P. 19802 vom 10. Februar 1882) verwenden jetzt bei dem durch Patent No. 6778 geschützten Canalofen, dessen Sohle von dem hochgelegenen Beschickungsende aus geneigt und zunächst geradlinig verläuft und dann durch eine curvenartige Krümmung gegen das Entleerungsende hin horizontal ausläuft, statt der dort angenommenen Streufeuerung auch Gasfeuerung. Zu dem Zweck ist ungefähr in der halben Länge des Ofens ein Generator angeordnet. Die in demselben entwickelten Brenngase treten von oben in das eingesetzte Brenngut und mischen sich daselbst mit der durch die abzukühlenden Steine streichenden, hierdurch stark vorgewärmten atmosphärischen Luft, so dass an dieser Stelle eine intensive Verbrennung stattfindet. Arth. Lehmann.

Statistik.

Im Deutschen Reich betrug, in metr. Centnern ausgedrückt, die

Waarengattung.	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an nicht glasirtem Töpfergeschirr	1 647	1 677	19 906	17 524
„ glasirtem Töpfergeschirr . . .	11 894	11 505	30 766	29 072
„ anderen Thonwaaren, ausser Porcellan etc., ausser Verbindung mit anderen Materialien	5 158	5 297	141 948	150 286
„ Porcellan und porcellanartigen Waaren, ausser Verbindung mit anderen Materialien	4 190	3 952	87 598	91 359

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XVIII. Kalk, Cement und Gyps.

Ueber die Gewinnung der Puzzolanerde in den Provinzen Rom und Neapel berichten Demarchi & Fodera (Dingl. polyt. Journal Bd. 246, p. 540 nach Engineering and Mining Journ. Bd. 34 p. 45) und geben als die in Rom gebräuchlichsten und bewährtesten Mischungsverhältnisse an:

für Roh-Bruchsteinmauerwerk	15	Kalk	: 85	Puzzolane
„ Backsteinmauerwerk	30	„	: 70	„
„ Verblendung mit Backsteinen	45	„	: 55	„
„ Pflaster in Ziegeln	36	„	: 64	„
„ Pflaster aus Geschieben u. Kies	22	„	: 78	„
„ Putz- und Stuckarbeit	40	„	: 60	„

Die beste hydraulische Mischung soll die Puzzolane von S. Pecolo mit 18 Proc. Kalk geben.

Denselben Gegenstand bespricht Otto Schulze (D. Töpf.- u. Ziegl.-Ztg. 1883, No. 24). Die grössten Gruben für Puzzolanerde sind bei Rom an der Via Tiburtina, an der Porta S. Lorenzo, der Via Ostiense und von S. Paolo, die bei Neapel von Bacoli, Montenuovo und Bassano.

Die Gesamtproduction betrug durchschnittlich in den letzten zehn Jahren 230 000 Tonnen im Werte von 1 Million Lire und beschäftigte ca. 220 Arbeiter.

Ueber die Gewinnung und Verwendung von Trass verbreitete sich Bücking im Architekten- und Ingenieur-Verein in Bremen (D. Töpf.- u. Ziegl. Ztg. 1883, No. 13) und betont, dass die Gewinnung der besten Sorten häufig durch den massenhaften Abraum beeinträchtigt ist, er warnt vor den vorkommenden Verfälschungen mit sog. wildem Trass. Guter Trass giebt bei einem Mischungsverhältnisse von 2 Vol. Trassmehl : 1 gelöschter Fettkalk : 2 Sand nach 40 Tagen Erhärtung die gleiche Druckfestigkeit wie eine Mischung von 1 Vol. Cement : 3 Sand und kostet per Cubikmeter Mörtel um 9 Mark weniger.

Ueber Roman Cement aus Dolomit schreibt Heintzel (Thonind.-Ztg. 1883, No. 23), dass diejenigen Dolomite, welche einen höheren Thongehalt besitzen, zuverlässiger sind und sehr günstige Resultate liefern; so liefere der Dolomit von Sinsleben, welchem noch geeignete Hochofenschlacke zugesetzt werde, nach 40 Tagen Erhärtung in Wasser noch mit 4 Teilen Sand über 10 kg Zugfestigkeit per Quadratcubikmeter.

Als hydraulischer Zuschlag hat die Hochofenschlacke überhaupt in der jüngsten Zeit viel von sich reden gemacht, und namentlich beschäftigte sich der Verein deutscher Cementfabrikanten in einer ausserordentlichen Generalversammlung im Juli 1882 und in der diesjährigen ordentlichen Generalversammlung mit der Frage des Zusatzes von Hochofenschlacke zu Portland-Cement, welche Manipulation teils offen mit der Begründung, der betreffende Cement werde dadurch verbessert, teils ohne Begründung und heimlich,

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also offenbar zum Zwecke der „Verdünnung“ betrieben wird und bedeutende Dimensionen anzunehmen drohte. Es wurden schliesslich folgende Resolutionen angenommen:

I. Portland-Cement ist ein Product, entstanden durch innige Mischung von Kalk und Thon, als wesentlichen Bestandteilen nach bestimmten Verhältnissen, darauf folgendem Brennen bis zur Sinterung und Zerkleinerung bis zur Mehlfeinheit.

II. Jedes Product, welches auf andere Weise entstanden ist, oder welchem während oder nach dem Brennen fremde Körper beigemischt werden, ist nicht als Portland-Cement zu bezeichnen. Ein Zusatz bis zu 2 Proc. Gips behufs Regulirung der Abbindezeit ist jedoch gestattet.

III. Der Verkauf eines Cementfabrikates, welchem fremde Körper beigemischt sind, unter der Bezeichnung „Portland-Cement“ ist daher als eine Täuschung der Consumenten zu betrachten.

IV. Guter Portland-Cement wird durch Zusätze fremder Körper im allgemeinen niemals verbessert. Aber selbst wenn im einzelnen Falle eine solche Verbesserung behauptet werden sollte, können die Zusätze dem Fabrikanten aus dem Grunde nicht gestattet werden, weil der Consument ausser Stande ist, die Höhe und Qualität dieses Zusatzes soweit zu controliren, um sich gegen Missbrauch zu schützen.

V. Erscheinen zum Zweck der Cementmörtelbereitung Zusätze gewisser anderer Körper zum Sande angebracht, so dürfen doch diese niemals vom Fabrikanten dem Cement beigemischt geliefert werden, sondern es ist die Vornahme dieser Zusätze dem Consumenten zu überlassen.

VI. Da die Normenprobe seiner Zeit für nicht mit fremden Körpern gemischten Portland-Cement aufgestellt worden ist, da ferner der besondere Charakter des Portland-Cementes durch die Zumischungen geändert wird, so können die Bestimmungen der Normen zum Vergleich zwischen gemischten und ungemischten Cementen nicht angewendet werden. (Thonind.-Ztg. 1883, No. 16; D. Töpf.- u. Ziegl.-Ztg. 1883, No. 19.)

Dem gegenüber hielt die Fabrik, welche offen Schlacke zusetzt, ihren Standpunkt fest und suchte durch Festigkeitszahlen zu beweisen, dass der Cement dieser Fabrik mit einer bestimmten Sorte Schlacke gemengt an Qualität und Gleichmässigkeit gewinne und beantragte ihrerseits:

1. man möge dahin streben, dass die in den Normen bestimmte Minimalzugfestigkeit des Portland-Cements um 60 Proc. erhöht werde;
2. man möge höheren Orts beantragen:
   a) statt der königlichen Prüfungsstation, welche nur rein mechanische Prüfungen des Cements auf Grund der Normen vorzunehmen im Stande ist, ein chemisch-technisch-mechanisches Prüfungsamt zu installiren, welches Vorschriften über alle Eigenschaften und die Minimal-Leistungsfähigkeit deutschen Portland-Cements aufstellt;

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b) gesetzliche Ueberwachung aller von deutschen Fabriken zu Wasser und zu Lande ausgehenden Cemente und der von fremdländischen Fabriken in Deutschland eingehen Cemente einzurichten;

c) Strafbestimmungen zu erlassen für deutsche Fabriken oder Händler, welche des Verkaufs ungenügender Cemente überführt werden.

(„D. Töpf.- u. Ziegl.-Ztg. 1883 No. 20.)

Diese Anträge wurden jedoch abgelehnt.

Infolge dieser mit grosser Animosität behandelten Verfälschungsfrage wurden namentlich Versuche gemacht, Methoden zu finden, um den Zusatz von Schlackenmehl nachzuweisen, welche aber bisher zu keinen völlig befriedigenden Resultaten führten. Während C. Heintzel (Dingl. Polyt. Journ. Bd. 247 S. 257 und Thonind.-Ztg. 1883, 9) auf chemischem und mikroskopischem Wege, ferner durch Abschlämmen und Analysiren des gröberen Teils Anhaltepunkte gefunden haben will und auch dem bei verfälschten Cementen nötigen höheren Wassergehalt Bedeutung zur Erkennung beimisst, spricht sich Schumann (Thonind.-Ztg. 1883 No. 26) dahin aus, dass die Feststellung des specifischen Gewichts mit grösstmöglicher Genauigkeit durch einen eigenen Volumenometer bestimmt, für die Erkennung gefälschten oder geringwertigen Productes genüge. Er stellt folgende Thesen auf:

1. Reiner Portland-Cement weist (mit dem Schumann'schen Volumenometer*) geprüft) ein specifisches Gewicht von wenigstens 3·1 auf. Ein Cement mit geringerem specifischem Gewicht ist entweder ein mit fremden Stoffen vermischter Portland-Cement oder ein Fabrikat von geringerer Qualität, welches als „Roman-Cement" zu bezeichnen ist.
2. Zur Entscheidung der Frage, ob ein Portland-Cement rein oder verfälscht ist, ist die genaue Ermittelung des specifischen Gewichts von hohem Wert.

Den Nachweis, dass mit Schlacke versertzter Cement schlechter sei als reiner, sucht ferner Rudolf Dyckerhoff in einer Reihe von systematisch angestellten Versuchen (Thonind.-Ztg. 1883 No. 17) zu führen und kommt zu dem Schlusse, dass guter Portland-Cement durch Zusätze fremder feinpulveriger Stoffe, wie Kalksilicate (in Form von Hochofenschlacke etc.), Trass, ferner Kalkstein und ähnliche Gesteine im ungebrannten oder auch gebranntem Zustande nicht verbessert, sondern verschlechtert wird.

Nach den anderseits producirten Zahlen scheint indess die Wahrscheinlichkeit vorhanden zu sein, dass bestimmte Cemente durch passenden Schlackenzusatz wirklich eine Verbesserung erfahren, wie denn auch Stimmen aus der Praxis ebenfalls constatiren (D. Töpf.- u. Ziegl.-Ztg. 1883 No. 13), dass die Qualität des qu. Cementes seit der Zeit, als offen eingestanden derselbe mit Schlacke gemischt wird, wenigstens nicht schlechter geworden sei.

Dass jedoch die Gefahr ausserordentlich gross und naheliegend ist, durch Verfälschung mit Schlacke den Ruf der deutschen Fabrikate zu schädigen,

*) Dasselbe ist ein grosses Pyknometer mit graduirter Röhre und bei Geissler in Berlin zu beziehen.

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beweisen auch bereits ausländische Stimmen. (The adulterated cement question in Germany. Builder 43 S. 584.)

Hochofenschlacke wird auch als Ersatz für Thon zur Portland-Cement-Fabrikation zwar seit langem schon benutzt, jedoch wurde ein neues Verfahren in der Anwendung derselben neuestens patentirt.

Verfahren zur Herstellung von hydraulischem Cement aus Hochofenschlacke, Kalkhydrat und Wasserglas von Vorwohler Portland-Cement-Fabrik, Prössing, Planck & Co. in Holzminden (D. P. 22299 vom 8. Juli 1882). Pulver von Kalkhydrat wird mit Schlackenmehl vermischt und mit soviel Wasserglaslösung versetzt, dass die Masse erstarrt. Aus derselben werden unter hohem Druck Steine gepresst, die dann bei Luftabschluss und in einem reducirenden Gasstrom gar gebrannt werden. Die Art des Brennens soll die Bildung von mangansaurem Kalk verhindern, der den Cement stark treibend macht.

Ebenso wird auch Bauxit als Cement-Rohmaterial vorgeschlagen.

Ludwig Roth in Wetzlar. Verfahren zur Herstellung von Cement durch Brennen von Bauxit mit kieselsäurehaltigen Materialien und Kalk. (D. P. 19800 vom 2. Februar 1882.) Um einen Cement mit 58 bis 63 Proc. Kalk, 22 bis 26 Proc. Kieselsäure und 6 bis 10 Proc. Thonerde herzustellen, werden kieselsäurereiche Rohmaterialien, und zwar besonders Hochofenschlacke, verwendet und dadurch auf die bezeichnete Zusammensetzung gebracht, dass man den Kalkgehalt durch Zusatz von Kalkstein oder Kalk, den Thonerdegehalt aber durch Zusatz von Bauxit auf die normale Höhe bringt. Die Rohmaterialien werden sehr vollständig gemengt, in Ziegel geformt, gebrannt und vermahlen.

C. Heintzel erhielt ein D. P. 23205 auf ein Verfahren zur Darstellung von weissem giessbaren Cement. Um der Bedingung billigen Preises und technischer Verwendbarkeit zu entsprechen, welche bisher die verschiedenen Vorschläge zur Darstellung weissen Cementes scheitern machte, ersetzt Heintzel den von Fahnehjelm vorgeschlagenen eisenfreien Thon oder die von rheinischen Fabriken versuchte Infusorienerde durch reinen Quarz und gewinnt so ein weisses Cementmehl, das mit Wasserglaslösung angerührt wird, rasch erhärtet und für Gussstücke in Leimformen sich vortrefflich eignet. Zu grösseren Güssen wird das Cementmehl noch mit der gleichen Menge weissen feinen Sandes vermengt. Hierdurch soll die leichte Giessbarkeit des Cementbreies vermehrt, die Abbindefähigkeit und Festigkeit des Gusses kaum vermindert werden, während der Kostenpunkt bedeutend niedriger gestellt wird. (Thonind.-Ztg. 1883, No. 29.)

Eine weitere Verwertung von billigen Rohmaterialien soll bezweckt werden durch Verfahren und Apparate zur Herstellung von Werkstücken aus Hochofenschlacke, Asche, Gyps und Wasserglas. Julius Bergmann in Hattingen a. d. Ruhr. (D. P. 20309.) Diese Erfindung bezweckt, zwei in den Hüttenrevieren sich sehr anhäufende Materialien, Hochofenschlacke und Steinkohlen- und Torfasche, zur Herstellung harter Steine zu verwerten.

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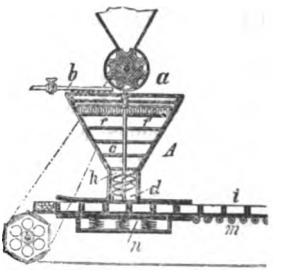
Die Aschen werden mit Natronlauge ausgekocht; mit der Asche werden dann neue Aschenmengen behandelt und zwar so oft, bis man eine concentrirte Wasserglaslösung erhält. Die Aschenrückstände werden nun mit der Wasserglaslösung und mit Wasser zu einem dünnen Brei angerührt, mit welchem Gyps (oder auch kohlensaurer Kalk) gut verrührt wird. Das Ganze bildet eine Kittmasse, mit der man die in Formen eingefüllten Schlacken übergiesst. Zur Herstellung der Kittmasse dient der Mischapparat *A* (Fig. 105); der darüber befindliche Verteiler *a* führt den Gyps, das Rohr *b* das Gemisch von Asche und Wasserglaslösung zu; beide Substanzen werden durch rotirende Arme *f* gemengt und durch die verschiedenen Etagen *c* geführt. Die Mischung wird dann durch die Schnecke *h* herausgepresst; mittelst des endosen Tuches *m* werden die mit Schlacke gefüllten Kästen *i* langsam unter der Austrittsöffnung des Trichters *d* vorüberbewegt, wobei sie durch das federnde Brett *n* fest gegen die Austrittsöffnung gepresst werden.

Fig. 105.

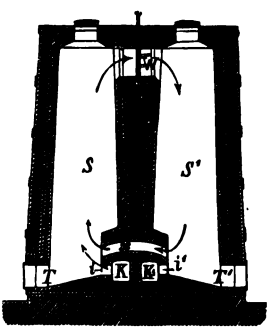


Cressy & Co. in Hastings hat ein Verfahren zum Erhärten von Kalksandziegeln angegeben. (D. P. 20890 vom 9. Mai 1882.) Sand, zerkleinerter Quarz oder Steinarten werden mit Kalkpulver oder pulverigem Kalkhydrat und wenig Wasser vermengt; das Gemisch wird in Formen gestampft. Den so erhaltenen Stein lässt man 2 bis 3 Tage stehen und setzt ihn nun in Wasser, in dem man etwas Kalk oder auch ein Calciumsalz aufgelöst hat. Das Wasser wird auf 95° C. erhitzt. Nach 2 bis 6 Tagen ist die Oberfläche erhärtet. (Dingl. polyt. Journ. Bd. 248, S. 514.)

Andere Neuerungen in Bezug auf Fabrikation und Verwendung von Mörtelstoffen sind: D. P. 23919 von C. Dietzsch in Malstatt. Ofen zum continuirlichen Brennen von Cement mit Vorwärmer zum Erhitzen der Masse vor Zugabe von Brennmaterial.

D. P. 19009 vom 4. December 1881 von Max J. Sachs in Breslau. Neuerung in der Befeuerungsweise zweier mit einander verbundener Schachtöfen. Das Gas kann entweder durch *K i* in Schacht *S* oder durch *K' i'* in Schacht *S'* geleitet werden. Ueber den Gasaustrittsstellen befindet sich die Luftpassage *x*. Die Feuerluft tritt oben in *S'* ein, während die Feuergase oben aus *S* austreten. Wird jedoch die Wechselklappe *W* verstellt, so tritt Luft oben in *S* ein, während die Feuergase oben aus *S'* abgesaugt werden. Die Schächte werden so betrieben, dass abwechselnd der eine

Fig. 106.



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befeuert wird, während in dem anderen die Verbrennungsluft beim Durchstreichen durch die glühenden Materialien vorgewärmt wird. Vor jedem Wechsel wird ein Teil des Inhalts aus dem zu brennenden Ofen abgezogen und dafür eine frische Charge aufgegeben.

D. P. 22696 vom 22. März 1882. Franz Morbitzer in Straza und L. Erdmenger in Gössnitz. Verfahren zur Herstellung eines basischen Futters in Cementbrennöfen. Das basische Schachtfutter besteht aus kohlensaurem Kalk oder Gemischen desselben mit kohlensaurer Magnesia, die so weit thonhaltig sind, dass sie nach dem Brennen gerade noch Cementrohmischung geben würden, oder es besteht auch aus Hochofenschlacken oder Pulver von Diabas und Dolerit. Die Masse wird entweder mit Wasser oder auch mit Teer, Asphalt oder anderen zusammenklebenden Substanzen vor dem Einstampfen angemacht. Das Schachtfutter wird entweder als Putz aufgetragen oder zum Ausstampfen des Innern der Wände benutzt, um das Anbacken des Cements zu verhindern, und ein leichteres Stürzen zu ermöglichen.

D. P. 19797 vom 22. Januar 1882. A. Samm in Stavenhagen. Formrahmen zur Herstellung von Cementplatten. Die Formen bestehen aus starkem Flacheisen, welches bei *a* durch ein Scharnier verbunden und bei *b* durch einen Knebel geschlossen werden kann. Fig. 107 zeigt eine fünffache Form zur Herstellung kleiner Fliesen, welche zwischen Achteckfliesen gelegt werden. Hier sind die Scheidewände an Wand *c d* befestigt. Eine Form zur Herstellung von Friesen ist oblong und mit einer beweglichen Zwischenwand versehen, welche durch Schrauben beliebig verstellt werden kann, um schmalere oder breitere Friese fertigen zu können.

Fig. 107.

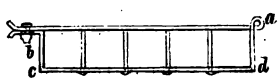
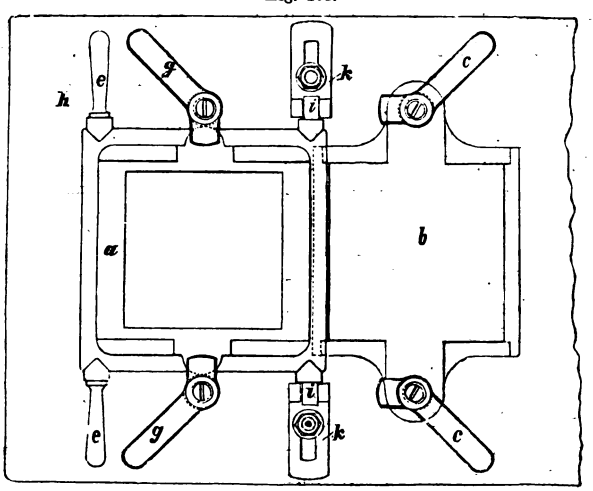


Fig. 108.



D. P. 19581 vom 22. December 1881. Jacob Grether in Freiburg, Baden. Neuerungen an Pressformen für Cement und Thonplatten. Der Rahmen *a* und die Bodenplatte *b* sind ohne Verbindung mit einander. Beim Pressen liegt *a* auf

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b, wobei beide Teile durch Drehung der Vorreiber *c* zusammengehalten werden. Nach dem Pressen löst man die Verbindung, ergreift den Rahmen *a* an den Handgriffen *e* und legt ihn auf den Ausstosstisch *h* um (Fig. 108); der Rahmen *a* dreht sich hierbei mit Zapfen *i* in kleinen, an den Tisch geschraubten Supports *k*. Mittelst der Vorreiber *g* wird *a* auf *h* befestigt.

Fig. 109.

Die Vorreiber *c* und *g* drehen sich auf Gewindebolzen *m* (Fig. 109), so dass sie sich beim Drehen etwas nach unten bewegen. Wenn die Angriffsflächen abgenutzt sind, so werden die Bolzen *m* gedreht.

D. P. 22289. Société anonyme de Certaldo in Paris: Neuerungen in dem Verfahren zum Härten und Färben von Gyps, Alabaster etc. Die Gegenstände werden in ein Bad gegeben, welches ausser Alaun noch Oxalsäure oder oxalsaure Salze enthält, wieder getrocknet und dann in die betr. Farbflüssigkeit getaucht. (Dingl. polyt. Journ. Bd. 248 S. 471.)

D. P. 19210. A. Keim in München. Verfahren zur Herstellung wetterbeständiger Wandgemälde. Aus gelöschtem Kalk, Sand und Wasser macht man einen Putz, der nach dem Trocknen mit rauhem Sandeteur abgerieben, und dann mit Kaliwasserglas getränkt wird. Der eigentliche Malgrund wird aus 4 Tln. Quarzsand, 3·5 Tln. Marmorsand, 0·5 Tln. Infusorienerde, 1 Tl. Aetzkalk und der erforderlichen Menge destillirten Wassers hergestellt. Nach dem Austrocknen wird dieser mit Kieselfluor-Wasserstoffsäure getränkt, worauf die Farben, welche mit entsprechenden Zusätzen zur Bildung von Silikaten versehen sind und vorher zur Verhütung des Nachdunkelns mit Alkalien behandelt wurden, aufgetragen werden. Das fertige Bild wird mit einer heissen Lösung von Kaliwasserglas bespritzt, getrocknet, sodann mit einer Lösung von Ammoniumcarbonat behandelt und schliesslich gewaschen. Nach einem Gutachten der kgl. bairischen Akademie der bildenden Künste in München soll das Verfahren technisch und künstlerisch vorzüglich sein. (Dingl. polyt. Journ. Bd. 248, S. 92.)

Auf ähnlichen Grundsätzen basirt das Verfahren von M. L. Kessler, weiche Kalksteine mittelst unlöslicher Kieselfluor-Verbindungen zu härten. (Compt. rend. Bd. 96, p. 1317.) Er betont, dass Wasserglasanstriche sich für die Conservirung von weichen Kalksteinen nicht bewährt haben, weil sich dabei immer lösliche Verbindungen bilden, welche Ausschläge und Vegetationswucherungen bewirken und selbst, wenn hinterher durch Kieselfluorwasserstoff versucht wird, die Verbindungen unlöslich zu machen, so gelinge dies nicht, da die richtige Mischung innerhalb der Poren herzustellen unmöglich sei, und weil auch die Kieselfluoralkalien sich wieder zersetzen, indem einerseits Fluorcalcium, andererseits freie Kieselsäure und kohlensaures Alkali, also wieder eine lösliche Verbindung entsteht, was man eben verhüten wollte. Noch mislicher jedoch sei dabei die Bildung einer firnissartigen Kruste, welche das Verdunsten der inneren Feuchtigkeit verhindere und so geradezu direct bei Frost das Abblättern bewirke. Aber durch eine

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concentrirte Lösung von Kieselfluor-Magnesium, -Aluminium, -Zink oder -Blei erlange man schon nach wenigen Anstrichen eine ganz beträchtliche Erhärtung unter Bildung von Fluorcalcium, freier Kieselsäure und Thonerde respective den Carbonaten von Zink und Blei, also lauter unlöslichen Verbindungen. Es bildet sich dabei kein undurchdringlicher Firniss, das Verfahren soll nicht viel teurer sein, als die frühere Behandlung und gestattet, die Oberfläche politurfähig und beliebig gefärbt herzustellen.

Nach E. Puscher's Verfahren zum Härten und Conserviren von Cementguss und Putzflächen (Dingl. polyt. Journ. Bd. 246 S. 530) legt man die Gegenstände 24 Stunden lang in eine kalte Lösung von 1 Teil Eisenvitriol in 3 Teilen Wasser und lässt sie dann trocknen. Es bildet sich dabei Eisenoxydhydrat und schwefelsaurer Kalk, die Sachen werden bedeutend dichter, härter und widerstandsfähiger gegen Witterung. Sie nehmen 10 Proc. an Gewicht zu. Verputz wird mit Eisenvitriollösung behandelt, sodann kommt ein zweimaliger Anstrich mit 5 procentigem Seifenwasser. Auch soll zuletzt eine Mischung von gleichen Teilen Paraffin und Erdöl zur völligen Widerstandsfähigkeit beitragen.

Von Mitzlaff (Notizbl. d. Ziegl.- u. Kalkbrenner-Ver. 1883 S. 31) teilt über die von ihm construirten hydraulischen Trockenpressen zur Anfertigung von Kunststeinen und Cement-Rohsteinen mit, dass er die Schwierigkeiten, die eingeschlossene Luft während des Pressens zu entfernen, nunmehr überwunden habe und mit Sicherheit unter einem Wassergehalt von nur ca. 4 Proc. per Minute 34 Steine von je 4 kg Gewicht liefere. Gegen Nasspressen erspare man in mehreren Cementfabriken bereits 19 Arbeiter per Tag. Diese Ausführungen werden von Michaelis bestätigt.

Zur Fixirung des Begriffes „steifer Kalkbrei" hatte der Ziegler- und Kalkbrenner-Verein eine Commission eingesetzt, deren Arbeiten wir folgendes entnehmen: Die Commission, aus Dr. Michaelis und Hauenschild bestehend, hatte sich durch Prof. Tetmajer in Zürich verstärkt, welch letzterer einen auf dem Princip des Araeometers beruhenden Steifigkeitsmesser construirte, der gestattet, die Tiefe des Eindringens eines Cylinders in eine Kalkbreimasse von bestimmtem Volum bei bestimmter Belastung genau zu constatiren. Die einzelnen Versuche geben hinlänglich genaue Resultate, jedoch stellte sich heraus, dass der Consistenzgrad des Kalkbreies selbst bei gleichem Wassergehalt, wesentlich variiren kann. Insbesondere wurde beobachtet:

1. Der Consistenzgrad eines Luftkalkbreies ist keine unmittelbare Function des Wassergehaltes. Es scheint, dass der Consistenzgrad eines Kalkbreies bei gleichem Wassergehalt mit der Lagerung des Stückkalkes an der Luft, sowie mit dem Gehalt an Magerungsbestandteilen abnimmt, d. h. der Brei ist bei gleichem Wassergehalt desto dickflüssiger, je fricher und reiner der Stückkalk gewesen.

2. Mittel, die das Aufgehen des Stückkalkes befördern (z. B. Löschen mit heissem Wasser) scheinen die Steifigkeit des Breies, gleiche Wassermengen vorausgesetzt, zu erhöhen.

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Zur Bestimmung der Ausgiebigkeit eines bestimmten Fettkalkes schlägt die Commission vor, nach einheitlicher Löschmethode (2·4 Gewichtteile heisses Wasser auf 1 Gewichtteil Aetzkalk) bis zur Normalconsistenz gebrachten Kalkbrei mit dem Volumen des Stückkalkes, bezogen auf die Gewichteinheit, zu vergleichen. Das Volumen von Stückkalk wäre durch plötzliches Eintauchen desselben in geschmolzenes Paraffin und rasches Herausheben volumetrisch unter Anbringung der Correctur für den Paraffinüberzug zu bestimmen. Demnach hängt dieselbe von dem Gehalte an fester Substanz ab, den ein Brei von Normalconsistenz besitzt.

Dr. Michaelis hat ferner durch eingehende Versuche festgestellt, dass die Behauptung Wolters', dass Kalk ohne Mithilfe von Dampf nicht zu brauchbarem Mörtelstoff gelöscht werden könne, hinfällig sei, dass hingegen die Beobachtung von Wolters richtig sei, die Kohlensäure könne erst dann unter wirksamer Verkittung aufgenommen werden, wenn sie, ohne dass Schwindung eintritt, die Wassermolecüle austreibt und sich an deren Stelle einlagert.

Deshalb ist auch die Aufstellung von Cokekörben zum Trocknen und Härten des Mörtels wirklich ein durchaus zweckentsprechendes Verfahren.

Ebenso fand Michaelis, dass Staubhydrat ceteris paribus stets stärkere Mörtel liefert als Kalkbrei. (Notizbl. d. Ziegl.- u. Kalkbr.-Ver. 1883 I. S. 55.)

Aehnliche Erfahrungen über die Anwendung von Staubhydrat statt Kalkbrei bringt die D. Töpf.- u. Ziegl.-Ztg. (1883 No. 13 u. 20.)

Ueber die Vorgänge beim Abbinden und Erhärten von hydraulischen Mörteln spricht sich Dr. Frühling aus (Thonind.-Ztg. 1883 No. 18). Er unterscheidet zunächst präcise den Vorgang des Abbindens von dem des Erhärtens, und betont, dass das hydraulische Abbinden wohl ohne Gegenwart von Kieselsäure, niemals aber ohne Thonerde erfolgen könne. Bezüglich der Erhärtung schliesst er sich der Anschauung an, dass dieselbe ein mehr mechanisch-physikalischer als chemischer Vorgang sei, dass also nicht die Bildung von bestimmten Silicaten die Grundlage der Erhärtung bilde. Selbst wenn sich bestimmte Silicate bildeten während der Erhärtung, so seien diese wenigstens stets so unconstant, dass es immer gelinge, die vermutete Verbindung durch Ammonsalze zu zerlegen. Kalkhydratbildung ohne Volumvergrösserung sei die Grundlage der verkittenden Eigenschaften; Kieselsäure und Thonerde spielen nur die Rolle von Agentien, welche bewirken, dass die Hydratbildung nicht plötzlich mit Volumvergrösserung, sondern nur allmälig stattfinde. Denn wenn die Volumvergrösserung des Kalkes auf irgend eine Weise verhindert werde, erhärte selbst reiner Kalk hydraulisch.

Fast alle mineralischen Salze und Oxyde, welche Hydrate bilden, dabei schwer, aber doch wesentlich im Wasser löslich sind, können in plastischer Form zu hydraulischen Mörteln hergerichtet werden.

Ausserdem berichtet Frühling, dass die bisher festgehaltene Wertbestimmung mittelst der Zugfestigkeit nicht ferner kritisirende Kraft haben könne, da viele Roman-Cemente die Normenfestigkeit guter Portland-Cemente erreichten. Dieselben seien jedoch in Folge ihres hohen Thonerdegehaltes

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empfindlicher gegen Austrocknen, und besitzen lange nicht die Widerstandsfähigkeit gegen Druck, sowie gegen Temperatur und Feuchtigkeitswechsel, wie gute Portland-Cemente. Schliesslich plaidirt er für eine neue Art Leichenbeisetzung durch Herstellung von Steinmumien aus Portland-Cement. (Ist schon vor 6 Jahren durch Benczur in Eperies empfohlen worden.)

E. M. Landrin (Compt. rend. 96, 3) unterscheidet bei den hydraulischen Mörteln eine Modification der Kieselsäure, die er im Gegensatze zu den anderen Modificationen hydraulische nennt und welche durch Einwirkung von Kalkwasser gebunden werden könne.

Le Chatellier (Compt. rend. 96, 4. p. 255) weist nach, dass damit nichts Neues gesagt sei, es sei längst bekannt, dass die hydraulisch wirksame Kieselsäure sich in Säuren und besonders in Alkalien löslich zeigt.

E. M. Landrin (Compt. rend. 96, 8. p. 491) gründet indess auf seine Entdeckung der hydraulischen Kieselsäure eine „unmittelbare Analyse der Puzzolanen" und ein rasches Verfahren, ihre hydraulischen Eigenschaften zu untersuchen, indem er den in Salzsäure unlöslichen Rückstand mit Kalkwasser titrirt, nachdem er früher zur Rotglut erhitzt wurde, und zwar durch 24stündiges Stehenlassen von 0·3 g mit 100 cbcm Kalkwasser und Zurücktitriren mit Salpetersäure.

Er fand bei vergleichenden Versuchen, dass in den Puzzolanen die Kieselsäure von den Oxyden nicht getrennt sei, da dieselben ohne vorherige Behandlung mit Salzsäure nicht durch Kalkwasser angegriffen würden.

In einer weiteren Arbeit fand Landrin mittelst Titrirung durch Kalkwasser, dass so lange Kalkwasser absorbirt werde, bis sich aus der hydraulischen, aus der gelatinösen und der Graham'schen Kieselsäure ein Silicat von der Formel $3\,SiO_2\,4\,CaO$ gebildet habe (Compt. rend. 96, 13. p. 841). Er nennt später dieses Silicat, welches er auch als den unlöschbaren Bestandteil des Chaux du Teil gefunden haben will: Pouzzo-Portland(!) (Compt. rend. 96, 17. p. 1229).

Le Chatellier (Compt. rend. 94, 23. p. 1668) studirte die Vorgänge der Wasserentbindung beim Gypsbrennen und fand, dass die Hitze sich nicht gleichmässig mit der Wärmezufuhr steigert, sondern zwischen 120 und 130° einerseits und dann zwischen 160—170° andrerseits längere Zeit stationär bleibe, von Wärme-Absorption während des Austreibens von Wasser herrührend. Das bei 140—155° resultirende intermediäre Hydrat entspricht der Formel $SO_3 \cdot CaO, 0{\cdot}5\,H_2O$, einem Wassergehalt von 6·2 Proc. übereinstimmend mit dem Wassergehalte gut gebrannten Gypses, der immer zwischen 6—7 pCt. liegt. Auch Johnston hat das gleiche Hydrat in dichtem Kesselstein nachgewiesen.

Ueber den Mechanismus des Abbindens von Gyps verbreitet sich Le Chatellier in geistvoller Weise (Compt. rend. 96, 11. p. 715) und betont, dass Marignac gefunden habe, bei 140° gebrannter Gyps gebe eine hoch übersättigte Lösung von 9 g per Liter. Er stellt sich nun das Abbinden als das Resultat zweier verschiedener aber gleichzeitiger Vorgänge vor.

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Einerseits bildet sich eine übersättigte Lösung von Gyps, andererseits lässt diese Lösung gleichzeitig Krystalle ansetzen an die nicht gelösten Teile, diese vergrössern ihr Volumen und berühren und verbinden sich dadurch. Dieses dauert so lange, als noch wasserfreier Gyps vorhanden ist, um die Uebersättigung der Flüssigkeit zu unterhalten. Giebt man eine kleine Quantität Kochsalz oder Schwefelsäure zum Löschwasser, so begünstigt dieses das Abbinden. Diese Zusätze erhöhen factisch die Menge Kalksulfat, welche in übersättigtem Zustande existiren kann; daraus schliesst er, dass das Abbinden der hydraulischen Mörtel ebenfalls von der Bildung übersättigter Lösungen herrühre und betont, dass er die Löslichkeit von Kalk-Aluminat schon bewiesen habe, und dass jedenfalls auch Kieselsäure und Kalk gleichzeitig sich eine gewisse Zeit in einer und derselben Lösung befinden können. In einer anderen Arbeit: Anwendung der Erscheinung der Uebersättigung auf die Theorie der Erhärtung einiger Cemente und Kitte (Compt. rend. 96, 15, S. 1056) erweitert Le Chatelier seine Theorie dahin, dass jedesmal, wenn ein Körper sich im status nascens in Berührung mit einem ihn lösenden Körper befindet und in grosser Menge als normal in Lösung existiren kann, sich eine übersättigte Lösung bilden muss. Er führt als Beweise an die Doppelsalze von $CaOSO^3$ und K^2O, SO^3, ferner die Oxychlorüre von Zink, Magnesia und Calcium, sowie die Kalk-Aluminate. Letztere zersetzen sich im Wasser und es lösen sich variable Mengen von Thonerde und Kalk, welche verschieden sind von der Verbindung, die mit Wasser behandelt wurde, die Hydrate hingegen lösen sich nicht. Wenn man ferner zu einer Lösung eines Aluminats ein gleiches Volum Kalkwasser giebt so beginnt ein Niederschlag schon nach einigen Secunden und ist nach einigen Stunden beendet. Es bilden sich Büschel von stralenförmig gruppirten Krystallen, welche sich bei langsamer Bildung in feste Sphärolithe verwandeln, welche im polarisirten Lichte das schwarze Kreuz zeigen. Sie entsprechen der Formel $Al^2O^3\,4CaO, 12H^2O, 9H^2O$. Die $9H^2O$ gehen schon bei 40° C. weg und entsprechen hygroskopischem Wasser. (Vergl. auch Techn.-chem. Jahrb. 1882. Im Grunde ist diese Theorie nur eine präcise Formulirung der Colloid-Theorie von Hauenschild, welcher schon auf die Eigenschaft der Para-Colloide, zu krystallisiren, hinwies und sich auf die Pfaundler'sche Hypothese eines doppelten Aggregatzustandes zur Erklärung übersättigter Lösungen berief.)

Der mechanisch-physikalische Vorgang des Abbindens hydraulischer Bindemittel wurde von Tetmajer näher studirt. (Schweizerische Bauztg. I., S. 9.) Insbesondere wurde der Process in seinem Zusammenhange mit der Temperaturerhöhung und den Festigkeitsverhältnissen charakterisirt und mit Hilfe einer graphischen Darstellung der Nachweis geliefert, dass der Beginn des Erstarrens oder Abbindens mit dem Beginne der Temperaturerhöhung zusammenfällt, und dass mit dem Maximum der Temperatursteigerung auch fast ausnahmslos das vollendete Abbinden eintritt. Um das Abbinden präcise zu bestimmen, wurde eine Modification der Vicat'schen Nadel hergestellt, deren

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unteres Ende von genau 1 mm² ein Gewicht von 300 g trägt und auf einen Cementkuchen von 4 cm Höhe und 8 cm Durchmesser in einer Metalldose in Breiconsistenz eingerüttelt, einwirkt. Als Beginn des Abbindens wird der Zeitpunkt betrachtet, sobald die Nadel den Kuchen beim freien Niederfallen nicht mehr bis zu seiner Basis zu durchdringen vermag, die Vollendung des Abbindens wird angenommen, wenn die Nadel keinen merkbaren resp. messbaren Eindruck mehr hervorbringt. Demnach lässt sich der Begriff des Abbindens jetzt viel schärfer präcisiren, und die Schweizer Normen haben als raschbindende Cemente nunmehr diejenigen bezeichnet, deren Erhärtungsbeginn innerhalb 8 Minuten fällt, als langsambindende diejenigen deren Erhärtungsbeginn über 30 Minuten hinausfällt. Werden Cemente über den Beginn des Abbindens hinaus verarbeitet, so erleiden sie in der Regel eine beträchtliche Einbusse an Festigkeit. Deshalb fordern die neuen Schweizernormen mit Recht allgemein, im Zeitraume vom Anmachen resp. Füllen der Dose bis zum Erhärtungsbeginn ist jedes Bindemittel zu verarbeiten, soll die Endfestigkeit der aus dem Materiale hergestellten Construction keinen Abbruch erleiden.

Wie wichtig die rechtzeitige Verarbeitung und überhaupt wie einflussreich auf die erreichbare Festigkeit die Methode der Verarbeitung ist, beweist schlagend Tetmajer in einer für die schweizerische Landesausstellung angestellten grossartigen Versuchsreihe von gegen 50 Sorten verschiedener hydraulischer Bindemittel. (Schweizerische Bauztg. I. No. 20.) Damit wurde gleichzeitig eine radicale Reform der bisher maassgebenden Normen angebahnt, da die Versuche nachwiesen, dass sowol Roman-Cemente, als auch hydraulische, Kalke, entsprechend verarbeitet, die besten Portland-Cemente an Normen-Zugfestigkeit erreichen können, hingegen an Druckfestigkeit deutlich und typisch nachstehen, so dass nur die Druckfestigkeit den natürlichen Uebergang von den wertvollsten Bindemitteln, den Portland-Cementen, zu den hydraulischen Kalken unzweideutig erkennen lässt. In den diesjährigen Generalversammlungen des schweizerischen Cementfabrikanten-Vereins und in der des schweizerischen Ingenieur- und Architekten-Vereins wurden demnach die Normen dahin abgeändert, dass der Erhärtungsbeginn für die raschen Cemente auf 19 Minuten, für die langsamen auf 30 Minuten festgesetzt wurde, und dass die Herstellung der Probekörper vollendet sein muss, bevor der Erhärtungsbeginn eingetreten ist, weshalb bei raschen Cementen die Dauer der Durcharbeitung auf 1 Minute, bei langsamen auf 5 Minuten präcisirt wurde. Dabei sind die Probekörper schneller Cemente stückweise für Zug- und Druck, die langsamer aber paarweise für Zug, stückweise für Druck anzufertigen, die Proben nach 7-, 28- und 84-tägiger normaler Wasser-Erhärtung vorzunehmen und die Durchschnittsziffer aus den 5 höchsten unter 10 für Zug, aus den 4 höchsten unter 6 für Druck als die maassgebende anzusehen. Die Zugprobe wird nur mehr als vergleichende Qualitätsprobe beibehalten, als ausschlaggebende wertbestimmende Probe gilt die Druckprobe an Würfeln von 10 cm Kantenlänge. Entscheidend für

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die Beurteilung bleibt die 28-Tageprobe und werden folgende Minimal-Festigkeiten angenommen:

	Zug	Druck
Portland-Cement	15 kg pro qcm	150 kg pro qcm
Roman-Cement	10 „ „ „	80 „ „ „
Hydraulischer Kalk	8 „ „ „	50 „ „ „

Ueber den Einfluss der verschiedenen Korngrössen von Sand auf die Zugfestigkeit veröffentlichte Böhme (Thonind.-Ztg. 1883) Versuche, aus denen hervorgeht, dass der grobkörnige Stettiner Sand höhere Normen-Festigkeiten ergiebt als der Berliner Normalsand, feiner Mauersand hingegen geringere, eine altbekannte schon vor der Aufstellung der Normen ventilirte Thatsache bestätigend. Hans Hanenschild.

Statistik.

Im Deutschen Reich betrug, in Meter-Centnern ausgedrückt, die

Waarengattung	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an Cement	251 751	254 650	2 496 743	2 712 980

Anhang: Künstliche Steine.

W. Poestges in Düsseldorf giebt im D. P. 20751 vom 9. Juni 1882 folgende Massen für künstliche Steine an. Gyps, in Alaunwasser zu Pulver gelöschter Kalk und Sand werden vermengt, und das trockene Pulver wird mit Leimwasser und Essigsäure angefeuchtet. Für Stucco u. dgl. fällt der Sand fort. Dieser Abputz kann mit Oelfarbe gestrichen werden. Für Façaden, welche nicht mit Oelfarbe gestrichen werden sollen, wird ein Ueberzug verwendet, der durch Mischen von Cementmörtel mit verdünnter Essigsäure erhalten ist. Um Mauern gleichmässig zu färben, wird die Farbe mit verdünnter Essigsäure und Schwefelsäure angerührt; die Farbe dringt tiefer ein.

Cressy & Co. in Hastings mengen nach dem D. P. 20890 vom 9. Mai 1882 Sand, zerkleinerten Quarz u. dgl. mit Kalkpulver oder pulverigem Kalkhydrat und wenig Wasser. Die hieraus geformten Kalksandziegel lässt man 3—10 Tage stehen und behandelt sie mit einer Kalklösung.

Um ein Bindemittel für Herstellung von künstlichen Mühlsteinen, Schleifsteinen, Fussbodenplatten etc. zu erhalten, setzen A. Simon und V. Petit in Paris (D. P. 20744 vom 25. Mai 1882) einer Mischung von Asphalt und Schwefel noch Gummilack hinzu. Die Stoffe werden geschmolzen und so mit den Mineralpulvern gemischt. Die Masse wird auf hydraulischen Pressen unter starkem Druck in Formen gepresst.

Künstliche Steine von W. Walker in New-York. (Engl. P. 1836

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vom 18. April 1882) sind aus 2 Gwt. Sand, 1 Gwt. Portland-Cement, $^1/_{12}$ Schwefel und $^1/_{12}$ Potasche zusammengesetzt. Damit die daraus geformten Blöcke haltbar werden, lässt man Dampf, welcher vorher durch Schwefelpulver gestrichen ist, darauf einwirken.

R. Michelet und L. Tescher in Berlin behandeln künstlich getrocknete, sowie leicht oder fertig gebrannte Steine oder Formstücke aus Aetzkalk oder Thon oder aus Thon, Lehm oder anderem Material, ebenso auch poröse Natursteine mit Teer, Asphalt u. dgl. (D. P. 22276).

Buchholz & Neddermann in Strassburg stellen poröse Mahlkörper aus Porcellan nach dem ewig wiederholten Verfahren der Beimischung organischer Stoffe zur Thonmasse her. (S. oben S. 127.)

Adolf Frank in Charlottenburg hat ein Verfahren zur Herstellung fester poröser Steinmassen aus Kieselerde und organischen Alkali- bezüglich Erdalkaliverbindungen im D. P. 21074 vom 6. December 1881 angegeben. Dasselbe beruht auf gleichzeitiger Anwendung verbrennlicher, organischer Stoffe mit Alkalien oder alkalischen Erden als Bindemittel für Kieselerde (oder Kieselguhr). So werden als Bindemittel verwendet: weinsaures Kali, weinsaures Kali-Natron, Rückstände der Zuckergewinnung aus den Rübensyrupen durch Elution, Zuckerkalklösung, Auflösungen von ätzenden, kohlensauren oder organischsauren Alkalien in Blut etc.

Die Mischung wird feucht angemacht, geformt, getrocknet und gebrannt. Hierbei verhindert die Verkohlung der zwischenlagernden organischen Stoffe ein Zusammensintern und Dichtwerden der einzelnen Kieselerdepartikelchen, während die Alkalien oder alkalischen Erden doch eine genügende chemische Bindung und Versinterung bewirken, um feste, poröse Massen zu erzielen. Je nachdem der Verglühprocess in offenen oder geschlossenen Gefässen stattfindet, verbrennt die organische Substanz vollkommen oder lässt sehr fein verteilten Kohlenstoff, zwischen der Kieselerde lagernd, zurück.

Diese Masse soll besonders zur Herstellung von kleinen Gefässen zur Aufnahme von desinficirenden Stoffen dienen.

Zur Absorbtion von Carbolsäure oder Brom, welche damit in fester Form dispensirt und dosirt werden können, setzt man die fertig gebrannten Stücke noch glühenden Alkalidämpfen aus oder glasirt sie auf andere bekannte Weisen äusserlich. Man gewinnt so nach aussen völlig dichte, flaschenartige Körper, die, nachdem an passender Stelle kleine Oeffnungen in den Glasurüberzug gemacht sind, die Flüssigkeiten begierig aufsaugen und danach durch ein geeignetes Material bis zum Gebrauch verschlossen werden können.

Um eine gleichmässige Farbe und Politurfähigkeit der aus Schwefel und Kohle, Silicaten, Metalloxyden etc. bestehenden Composition für Abgüsse, Zeichenstifte, Cement u. dgl. zu erzielen, setzt J. J. Sachs in Manchester der im D. P. 14718 beschriebenen Massen*) noch Schiefersteinpulver zu (D. P. 17510).

*) Techn.-chem. Jahrb. 1882 S. 215.

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Borchert in Berlin fertigt Firmenbuchstaben u. dgl. aus mit Borax und Alaun angemachtem Tripolith*) unter Einlegung wellenförmiger Stäbe oder Drähte. Die Gegenstände werden dann in Leinölfirnis gekocht und getrocknet. (D. P. 20880 vom 19. März 1882.)

Nach der Société anonyme de Certaldo in Paris (D. P. 22289 vom 2. August 1881) werden die aus Rohgyps geschnittenen Gegenstände getrocknet und dann gehärtet, indem man sie in ein Bad taucht, dem man neben dem früher angewendeten Alaun noch Oxalsäure oder auch oxalsaure Salze hinzugesetzt hat. Die gehärteten Gegenstände werden wiederum getrocknet und dann in die Flüssigkeit getaucht. Die angewendete Härtungsflüssigkeit gestattet auch, die Färbung mit der Härtung zu vereinigen, indem man dem ersten Bade den Farbstoff, Fuchsin etc. beimischt.

Die Vorwohler Portland-Cement-Fabrik, Brüssing Planck & Co. in Holzminden stellt hydraulischen Cement aus Hochofenschlacke, Kalkhydrat und Wasserglas her. (D. P. 22299 vom 8. Juli 1882 s. oben S. 154.)

Zische in Deuben bei Dresden stellt Feilen als Ersatz für gehauene Stahlfeilen her, indem ein Kern aus Holz, Metall oder anderem zweckentsprechenden Material, der von etwas geringeren Dimensionen ist, als die herzustellende Feile, mittelst Pressung mit einem Schmirgelmantel umgeben wird. (D. P. 20955 vom 25. December 1881.)

Ein Ersatzmaterial für natürlichen Asphaltstein bei Herstellung von Asphalt in Mastix- und Pulverform erhält man nach C. Brasche und L. Mitgau in Braunschweig (D. P. 20885 vom 16. April 1882) aus Rohgyps, dem durch Trocknen oder Brennen das Krystallwasser mehr oder weniger entzogen ist, und der in Stücken mit Mineralöl gesättigt wird. Alsdann wird derselbe wie natürlicher Asphaltstein behandelt, nämlich fein zerkleinert und entweder mit Zusatz von Teerasphalt zu Asphaltmastix gekocht oder mit Zusatz von Petroleumerde zu Asphaltpulver für Stampfarbeiten verarbeitet.

Julius Nagel in Galgocz, Ungarn, fertigt feuersichere Platten, indem ein Gemisch von frisch geglühtem Zinkoxyd und im Holländer zerkleinertem Asbest in halbfeuchtem Zustande auf ein Eisendrahtnetz aufgewalzt wird. Nachdem die so erzeugte Platte etwas getrocknet ist, wird sie in eine Lösung von Chlorzink gelegt und darauf wieder gewalzt. Man trocknet die Platte und bringt sie wieder in eine Chlorzinklösung, wäscht sie mit Wasser gut aus und walzt sie nochmals. Für den Fall, dass diese Platten vollständig wasserdicht sein sollen, werden sie zunächst mit einer Wasserglaslösung und darauf mit abgerahmter Milch getränkt, wodurch sich eine unlösliche, die Poren verkittende Casein-Wasserglasverbindung bildet. (D. P. 19808 vom 25. Februar 1882.)

Kirchner & Goepel in Schweinfurt stellen einen feuersicheren Asbest-Leinen-Eisen-Filz her. (D. P. 20697 v. 29. December 1881.) Ein Gemisch von Asbest- und Leinenfasern wird wie Papiermasse auf dem Holländer klein gemahlen. Die Masse wird alsdann ausgepresst und der Filz in einem Rühr-

*) Vgl. Techn.-chem. Jahrb. 1882, S. 216.

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bottich mit dünner Leim- und Wasserglaslösung zu einem flüssigen Brei angerührt. Eine Bahn schwachen Eisengeflechts wird durch Walzen unter dem Auslauf des Rührbottichs hingeführt, so dass die Masse gleichmässig darauf sich ergiesst. Die Flüssigkeit fliesst durch die Drahtmaschen ab und die Filzfasern werden in die Maschen eingesogen. Die so belegte Drahtgeflechtbahn läuft dann durch die Nasspresswalzen und sodann durch den Calander.

Um gegossene bezw. gepresste Schlackenstücke zu kühlen, werden dieselben nach Badenberg in Steele (D. P. 22441 vom 2. Sept. 1882) in noch heissem Zustande mit Sand etc. beworfen und mit Schlacke umgossen, wodurch die Abkühlung der inneren Schichten sehr gleichmässig erfolgt. Nach dem Erkalten wird der nur schwach am Kern haftende Mantel zerschlagen und entfernt.

XIX. Explosivstoffe.

Allgemeines. — Weitaus das grösste Interesse auf dem Gebiete der Explosivstoffe beansprucht gegenwärtig die rasche Verbreitung der neuen Nobel-schen Sprengstoffe, der Sprenggelatine und der Gelatinedynamite und die hiermit gleichbedeutende Zurückdrängung des Kieselguhrdynamits. Letzteres ist in Oesterreich-Ungarn und in Schweden bereits vollständig durch jene Präparate mit gelatinirtem Nitroglycerin ersetzt. Auch in den übrigen Ländern Europas, wie Schweiz, Italien, Deutschland, Frankreich, England bürgern sich die Sprenggelatine und die Gelatinedynamite immer mehr ein. Beispielsweise kamen diese neuen Sprengstoffe bei Herstellung des St. Gotthardtunnels in grossem Maasstabe zur Verwendung. Grössere Unempfindlichkeit gegen Schlag, Stoss und Reibung; grössere chemische Stabilität; Unempfindlichkeit gegen Wasser; bessere Explosionsgase; Ersparnis an Arbeit und Beschleunigung des Fortschrittes der Arbeit — das sind die wesentlichsten Vorzüge der neuen gelatinirten Sprengstoffe*) gegenüber dem Guhr-Dynamit.

Die Methoden der qualitativen und quantitativen Analyse der Dynamite sind in den beiden letzten Jahren vielfach erweitert und vervollkommnet worden. Namentlich gehören hierher die Arbeiten von Hauptmann F. Hess**), Lunge***), Walter Hempel†) und W. Hampe††).

*) Näheres über dieselben siehe unter III B, 2.

**) In den Mitteilungen aus dem chem. Laboratorium des k. k. technischen und administrativen Militärcomités, z. B. Heft 1, 1881: „über die chemische Analyse der Nitroglycerin-Sprengmittel."

***) Dingl. polyl. Journ. **245**, (1882) S. 171.

†) Zeitschr. anal. Chem. **20**, (1881) S. 82.

††) „Ueber die Analyse der Sprengstoffe". Sonderabdruck aus der „Zeitschr. f. d. Berg-, Hütten- u. Salinenwesen im preussischen Staate". Bd. XXXI. Berlin. Ernst und Korn.

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I. Schiesspulver.

Die chemische Theorie des Schiesspulvers wird von H. Debus (Liebig's Annal. **212**, 315; **213**, 15) sehr ausführlich besprochen. Nach ihm besteht die Pulververbrennung aus zwei ihrem Wesen nach durchaus verschiedenen Processen, einem Oxydationsprocess (identisch mit der eigentlichen Explosion des Pulvers) und einem Reductionsprocesse. Der Oxydationsprocess verläuft nach der Gleichung:

$$10KNO^3 + 8C + 3S = 2K^2CO^3 + 3K^2SO^4 + 6CO^2 + 5N^2.$$

Falls sich jedoch in diesem ersten Stadium der Verbrennung auch Kohlenoxyd bildet — was Debus für wahrscheinlich hält — so wird man statt dessen folgende Gleichung annehmen müssen:

$$16KNO^3 + 13C + 5S = 3KCO^3 + 5K^2SO^4 + 9CO^2 + CO + 8N^2.$$

Für den Reductionsprocess stellt Debus folgende Formeln auf:

1. $4K^2SO^4 + 7C = 2K^2CO^3 + 2K^2S^2 + 5CO^2$
2. $4K^2CO^3 + 7S = K^2SO^4 + 3K^2S^2 + 4CO^2.$

Das zweite Stadium der Verbrennung wird also dadurch gebildet, dass der vom ersten Stadium übrige Rest von Schwefel und Kohle auf das gebildete kohlensaure Kali, resp. schwefelsaure Kali einwirkt. Beide Reactionen sind endothermische, Wärme verbrauchende und nicht explosive, wodurch sie sich also scharf von dem ersten Stadium der Verbrennung unterscheiden.

Entstehung des explosiven Zinnnitrates beim Mischen und Verdichten des angefeuchteten Pulversatzes. Auf der kgl. Pulverfabrik zu Spandau wiederholt bei dieser Operation eingetretene Entzündungen veranlassten R. Weber, die Ursache derselben zu erforschen. Das Mischen und Verdichten geschieht in Spandau durch Läuferwerke, an deren Walzen bronzene Abstreicher angebracht sind, welche durch Zinnbleilot mit ersteren verbunden waren. Es hatte sich nun nach Weber zuerst durch die Einwirkung des Schwefels des Pulversatzes auf das Kupfer der bronzenen Abstreicher Schwefelkupfer gebildet, welches sich leicht zu schwefelsaurem Kupferoxyd oxydirte. Letzteres setzte sich mit dem Salpeter des feuchten Pulversatzes zu salpetersaurem Kupferoxyd um. Dieses in Berührung mit dem Zinn gab das basische Zinnnitrat $Sn^2N^2O^7$, welches explosive Eigenschaften besitzt. Verf. warnt desshalb, Zinnlot an genannten Stellen zu verwenden und empfiehlt statt dessen die Verbindung solcher Teile durch Vernietung oder Verschraubung. (J. prakt. Chemie **26**, S. 121.)

Ueber die Anlage von Pulverfabriken. Von A. Steiger. (Prakt. Maschinenconstruct. 1882, S. 222 u. 241.)

Neuerungen an Pressen für prismatisches Pulver. (D. P. 20256 vom 4. April 1882. H. Gruson in Buckau bei Magdeburg.) Die Pressstempel wirken von unten und oben, das Pulver durch die in einem feststehenden Tisch angebrachten Matrizen von zwei Seiten zusammendrückend. Der Tisch ist mit Hohlräumen versehen, um demselben die zum

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Pressen nötige Temperatur durch Einleiten von Dampf erteilen zu können. Die Pressstempel sind in verticaler Richtung federnd mit den an den Excenterstangen befestigten Traversen verbunden. Zur Hervorbringung der federnden Wirkung können Gummi-, Feder-, Luft- und hydraulische Puffer verwendet werden. Es wird durch letztere Vorrichtungen eine Verlängerung der Druckdauer beabsichtigt.

Stempel und Matrizen zur Herstellung von prismatischem Pulver. (D. P. 22734 vom 6. December 1882. Wilhelm Lorenz in Karlsruhe.) Die Prismenstempel-Matrizen sind zusammengesetzt aus einem runden Kern bezw. einem Mantel von runder Bohrung und einem vielkantigen Ueberzug bezw. vielkantigem Futter, welche letzteren mittelst Ziehens und Pressens aus comprimirtem harten Metall hergestellt werden und nach der Abnutzung entfernt und durch neuen Ueberzug bezw. neues Futter ersetzt werden können.

II. Schiessbaumwolle.

Die grossen Erwartungen, welche man anfangs von der comprimirten Schiessbaumwolle (besonders in England) hegte, haben sich bis jetzt nicht erfüllt. Der einzige, allerdings unbestreitbare Vorteil der Schiessbaumwolle — ihre hohe Unempfindlichkeit gegen mechanische und Temperatureinflüsse, speciell gegen Gefrieren — wird durch ihre grossen Nachteile vollkommen in Schatten gestellt. Diese Nachteile bestehen hauptsächlich in ihrem geringen specifischen Gewicht, der Incomprimibilität der Patronen und den schädlichen Explosionsgasen. Ausserdem ist ihre Sprengkraft, bezogen auf Gewichtseinheit, höchstens gleich jener des Guhrdynamits. Sie kann deshalb weder mit letzterem, noch gar mit den neuen Nobel'schen gelatinirten Sprengpräparaten concurriren. Ja nicht einmal zu einem Sprengstoff zweiter Stärke eignet sie sich, so lange nicht ihr Preis ein bedeutend niedrigerer wird.

Wegen des geringen specifischen Gewichtes der Schiessbaumwolle und der Incomprimibilität ihrer Patronen muss man bei Anwendung dieses Sprengstoffes eine relativ sehr lange Zündkammer anwenden. Guhrdynamit lässt sich im Gegensatze zur Schiessbaumwolle nach Georgi*) durch Stampfen um ein Achtel bis ein Sechstel der Länge der lose auf einander liegenden Patronen zusammenpressen, somit zu innigerem Anschmiegen an die Bohrlochswandung und zu besserer Ausnutzung der Sprengkraft bringen.

Nicht zu unterschätzen ist auch noch ein anderes der Schiessbaumwolle ungünstiges Moment: die Abneigung der Arbeiter gegen dieselbe.

Nach einer Mitteilung in „Glückauf" (1882 No. 11 und 13) sollen Petry und Fallenstein in Düren unter der Bezeichnung „nitrirte Baumwolle" einen Sprengstoff hergestellt haben, welcher die Vorteile der Schiessbaumwolle ohne ihre Nachteile besitze. Namentlich sollen die Explosionsgase dieses neuen Sprengstoffes weniger unangenehm sein als die des Guhr-

*) „Resultate der Anwendung neuerer Sprengmaterialien". (Jahrbuch für Berg- und Hüttenwesen 1882.)

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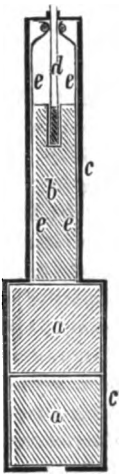
dynamites. Günstige Sprengversuche mit dieser nitrirten Baumwolle habe man beispielsweise auf der Grube Diepenlinchen bei Stolberg angestellt.

Fig. 110.



Sprengen mit comprimirter Schiessbaumwolle unter Wasser. (D. P. 22418 vom 1. September 1882. Max von Förster in Berlin.) In der Zeichnung sind *aa* Stücke Schiessbaumwolle, *b* ist die Zündpatrone mit comprimirter Schiessbaumwolle, *d* die Zündschnur mit Zündhütchen. Der Gummischlauch *e* umschliesst die Zündpatrone und ist oben um die Zündschnur wasserdicht festgebunden, so dass, falls die Patrone unter Wasser gebracht wird, dieses nur von unten her in die Schiessbaumwolle eindringen kann. *c* ist eine Blechbüchse, welche die ganze Ladung umschliesst, aber sowohl oben wie unten Wasser einlässt. Die Patrone wird dann inexplosibel, wenn das Wasser von unten her die ganze Schiessbaumwolle in der Zündpatrone durchnässt hat, was bei einer Patrone von 30 mm Durchmesser, 120 mm Länge sicher nach 22 Stunden erfolgt ist, während die Patrone noch so lange explosibel bleibt, als sich noch trockene Schiessbaumwolle in der Nähe des Zündhütchens befindet, was sicher 10 Stunden lang währt. Ein nachträgliches Explodiren einer versagenden Ladung ist daher 22 Stunden nach Legung derselben ausgeschlossen.

Ueber Entstehungsweise und Eigenschaften der verschiedenen Nitrocellulosen berichtet Vieille. (Compt. rend. **95**, 132.)

Anhang: Das Celluloid.

Die vom Referenten in seiner gleichnamigen Schrift*) ausgesprochene Ueberzeugung, dass das Celluloid aller Anfeindungen der Concurrenz ungeachtet eine dauernde Bedeutung behalten werde, scheint sich zunächst hinsichtlich seiner Anwendung als Ersatz für Wäscheartikel von Leinen und Shirting bewahrheiten zu wollen. Manschetten, Kragen, Vorhemden von Celluloid werden jetzt von Vielen getragen. Die Celluloidkragen verlieren durch Einwirkung der Transpiration leicht die Form, da das Celluloid durch Wärme bekanntlich plastisch wird. Diesem Uebelstand lässt sich indessen leicht dadurch abhelfen, dass man die formentstellten Kragen in heisses Wasser eintaucht und sie, nachdem sie vollkommen plastisch geworden sind, wieder ausbügelt.

Interessant ist es übrigens zu beobachten, wie die Celluloidwäsche unter allen möglichen Namen — wie „Gummiwäsche“, „Hyattwäsche“**), „wasserdichte Leinwand“ — in die Gunst des Publikums sich einschmuggelt. Die albernen Gerüchte über Explosionsfähigkeit und hohe Feuergefährlichkeit des Celluloids, welche von der Concurrenz vor 3—4 Jahren ausgesprengt wurden, sind die Ursache dieser angenommenen Maske.

*) Techn.-chem. Jahrb. 1882, S. 154.

**) Nach Hyatt, dem Erfinder des Celluloids, so genannt.

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Einige Mitteilungen über die Herstellung des Celluloids macht H. Echenoz (Génie civ. 1882, S. 473).

III. Nitroglycerinsprengstoffe.

A. Nitroglycerin.

Die Darstellung des Nitroglycerins in der Nobel'schen Dynamitfabrik zu Pressburg. (H. Münch, in d. Wochenschrift des österr. Ingenieur- und Archit.-Vereins 1882, S. 203; Wagner's Jahresber. 1882, S. 407). Verfasser hebt folgende bemerkenswerte Einzelheiten der Darstellung hervor. Das frische Gemisch von Salpetersäure und Schwefelsäure wird mittelst Druckgefässe zum Nitrirapparat geführt. Dieser Apparat sowie jener, in welchem das Nitroglycerin vom Säuregemisch getrennt wird, ist mit Glasdeckeln und Beobachtungslinsen versehen, lange, in das Innere des Apparates hineinragende Thermometer gestatten die beständige und bequeme Ablesung der Temperatur des Gemisches. Ausser den Zuleitungsröhren des Glycerins und des Säuregemisches hat der Nitrirungsapparat noch Röhren für Zuleitung von kaltem Wasser und kalter Luft. Der den Nitrirungsprocess beaufsichtigende Arbeiter hat darauf zu achten, dass die Temperatur nicht über 30° steigt. Ist dies aber der Fall, so hat er den Zuflusshahn von Glycerin teilweise oder ganz zu schliessen und hierfür den Zuflusshahn für Wasser stärker zu öffnen oder die Luftrührung zu steigern. Wenn dies Alles nichts hilft oder sich rote Dämpfe zeigen, so dreht der Arbeiter rasch die Zuflusshähne für Glycerin und Säure zu und öffnet ebenso rasch einen am Boden des Nitrirapparates befindlichen Hahn, wodurch die ganze Mischung in einen darunter stehenden, mit kaltem Wasser gefüllten Behälter entleert wird.

Die „Abfallsäure", d. h. das Gemisch von Schwefelsäure und Salpetersäure, welches nach dem Nitrirungsprocess vom Sprengöl geschieden wurde, wird zunächst zur Wiedergewinnnung der Salpetersäure und die restirende verdünnte Schwefelsäure zur Superphosphatfabrikation benutzt. Durch diese Wiedergewinnung wird selbstverständlich der Herstellungspreis des Nitroglycerins, resp. der Dynamite beträchtlich reducirt.

Ueber Herstellung und Verwendung von Nitroglycerin in Schweden haben G. Nordenström und A. W. Cronquist eine Abhandlung veröffentlicht. Aus derselben entnehmen wir u. a., dass an einigen Orten in Schweden noch Nitroglycerin als solches zum Sprengen verwendet wird. Zur vergleichenden Messung der Sprengkraft der einzelnen Sprengstoffe wendet man in Schweden neben der (weiter unten beschriebenen Trauzl'schen Brisanzprobe folgende Methode an. Man feuert aus einem besonders construirten Mörser eine schwere Kugel ab, was durch die Explosion einer möglichst kleinen Ladung des Sprengstoffes bewirkt wird. Die Länge des von der Kugel zurückgelegten Weges ist der Stärke des Sprengstoffes direct proportional. (Om Nitroglycerinhaltiga Sprängämnen, Stockholm 1880. Von da übergegangen in Bg.- u. hüttenm. Ztg. **41**, 273.)

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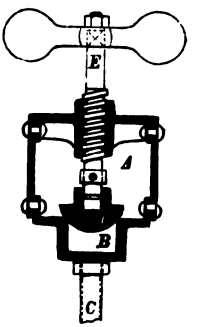
Fig. 111.



Trichter an Vorrichtungen zur Darstellung von Nitroglycerin (D. P. 17568 vom 20. September 1881. Otto Schilling in Kattowitz.) Der Trichter soll den Zufluss des Glycerins zum Säuregemisch reguliren, und besteht aus dem Sammelkasten *A* und dem Verteilungskasten *B*, in welchem mehrere Abfallrohre *C* eingeschraubt sind. Der Zugang zum Kasten *B* wird durch Ventil *D*, welches an der Spindel mit Handhabe *E* befestigt ist, regulirt.

Die Wiederverwandlung des Nitroglycerins in Glycerin. C. L. Bloxam schlägt zu diesem Zwecke zwei Methoden vor. 1. Mit alkoholischem Kaliumsulfhydrat (KHS). Man bereitet letzteres, indem man Kalihydrat in mit Methylalkohol versetztem Spiritus auflöst und die Lösung mit Schwefelwasserstoff sättigt. Diese Lösung setzt man zu der Lösung des Nitroglycerins in Methylalkohol. Die Flüssigkeit erwärmt sich hierbei bedeutend, wird rot und scheidet Schwefel aus. 2. Man kocht Schwefelblumen und gelöschten Kalk in Wasser, bis eine völlig orangefarbene Lösung erhalten wird. Dieselbe wird filtrirt und etwas Nitroglycerin hineingegossen. In diesem Falle geht zwar die Umwandlung langsamer vor sich und muss durch Rühren mehr unterstützt werden, ist aber doch in wenigen Minuten vollendet. Man filtrirt die Flüssigkeit vom ausgeschiedenen Schwefel ab. Nach dem Verfasser lassen sich vielleicht auch die Schwefelcalciumrückstände der Leblanc'schen Sodafabrikation zu diesem Umsetzungsprocess verwerten. (Chem. Ztg. **7**, 560 aus Chem. News **47**, 169.)

B. Dynamite.

1. Allgemeines.

Wie schon in der Einleitung hervorgehoben wurde, behauptet der Guhr-Dynamit seine Alleinherrschaft nicht mehr. Sprenggelatine und die Gelatine-Dynamite machen ihm dieselbe seit drei Jahren streitig, und schon jetzt ist vorauszusehen, dass der Kampf mit der völligen Zurückdrängung des Guhrdynamits enden wird.

Als Nobel die gefährlichen Eigenschaften des Sprengöles in dem Kieselguhr-Dynamit gebannt hatte und hiermit ein Sprengstoff erhalten wurde, welcher neben der gewaltigen Kraftwirkung eine relativ beträchtliche Gefahrlosigkeit in der Handhabung in sich vereinigte, so waren die Tage des Schiesspulvers als Alleinherrschers in der Sprengtechnik bald gezählt. Der zwischen Schiesspulver und Dynamit entbrennende Kampf wüthete in den Jahren 1875 und 1876 noch heftig, bis er im Jahre 1877 plötzlich mit der völligen Zurückdrängung des Schwarzpulvers endigte.

Allein der Guhr-Dynamit hatte neben seinen grossen Vorzügen auch seine unangenehmen Nachteile. Im Wasser oder unter Druck giebt er einen Teil des Sprengöles leicht ab, nach der Explosion bleibt ein förmlicher

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„Kometenschweif" von fein verteiltem Kieselguhrstaub in der Luft suspendirt, und abgesehen von diesen Nachteilen gelangt bekanntlich im Guhr-Dynamit nur ein Bruchteil der Sprengkraft des reinen Sprengöles zur Geltung. Der Guhr-Dynamit No. I besteht aus 75 Proc. Nitroglycerin und 25 Proc. Kieselguhr. Von diesen 75 Proc. gehen aber noch etwa 8 Proc. verloren, um den Kieselguhr bei der Explosion zu erwärmen. Es hat folglich Kieselguhr-Dynamit nur ca. 67 Proc. der Sprengkraft des reinen Sprengöles. Es handelte sich also darum, einen Sprengstoff zu finden, welcher das Nitroglycerin weder in Wasser noch durch Druck abgab, und dessen Sprengkraft nicht durch einen inerten Aufsaugestoff, wie das Kieselguhr, vermindert wurde. Diesen Sprengstoff fand Nobel in der Sprenggelatine. Indessen zeigte auch dieser Sprengstoff gewisse Unannehmlichkeiten, welche für manche Fälle das Guhr-Dynamit wieder vorziehen liessen. Diese Nachteile bestehen einmal in der ziemlich grossen Schwierigkeit der vollständigen Explosion einer Ladung. Selbst durch 1 g Knallquecksilber enthaltende Kapseln können freiliegende Ladungen nicht zur Explosion gebracht werden. Man muss deshalb eine Zündpatrone von Gelatine-Dynamit No. I, Guhr-Dynamit oder Cellulose-Dynamit zur sicheren und vollständigen Explosion der Sprenggelatine anwenden. Ein weiterer Nachteil der Sprenggelatine ist ihre grosse Zähigkeit und Elasticität. Wegen dieser Eigenschaften ist es auch bei kräftigem Niederpressen der Besatze nicht möglich, das Bohrloch satt auszufüllen, wodurch also die völlige Ausnützung des Bohrlochraumes unmöglich gemacht wird. Endlich gehört die Sprenggelatine zu denjenigen Sprengstoffen, deren Wirkung eine ausserordentlich zermalmende ist. Sie eignet sich deshalb nicht (ebensowenig wie Dynamit No. I) zum Abbau von Nutzsteinen und Kohlen, zu Ausweiterungen auf das normale Profil bei Tunnelbauten u. s. w.

Diese Uebelstände der Sprenggelatine werden mit Anwendung der Gelatinedynamite (siehe weiter unten) vollkommen vermieden. Sprenggelatine und Gelatinedynamit sind also zwei Sprengstoffe, welche sich in ihren Eigenschaften aufs beste ergänzen und welche deshalb stets nebeneinander bei Sprengungen angewendet werden. So benutzte man beim Bau des St. Gotthard-Tunnels die zermalmende Wirkung der Sprenggelatine zum Brechen und Zertrümmern des harten Gesteines, während der Gelatinedynamit zu den difficileren Ausweiterungen auf das normale Profil u. dgl. benutzt wurde.

2. Die einzelnen Dynamite.

a) Sprenggelatine und Gelatinedynamite. Beide Sprengstoffe verhalten sich in den meisten chemischen und physikalischen Eigenschaften gleich, weshalb sie hier gemeinschaftlich besprochen werden.

A. Nobel, welcher sich um die Vervollkommnung der Fabrikation der Sprengstoffe und hiermit zugleich um die ganze Menschheit so grosse Verdienste errungen hat, fand, dass eine bestimmte Sorte Collodiumwolle sich in Nitroglycerin löst und schon geringe Mengen davon genügen, das Nitro-

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glycerin in einen dickflüssigen, gallertartigen, oder bei etwas grösserer Menge von Collodiumwolle in einen festen, gummiartigen Körper überzuführen. Er nannte den neuen Sprengstoff Sprenggelatine.

Die Sprenggelatine ist eine gummiartige, elastische Masse von gelber bis brauner Farbe, welche aus 93 Proc. Nitroglycerin und 7 Proc. Collodiumwolle besteht. Sie ist also — im Gegensatz zum Guhrdynamit — aus Bestandteilen zusammengesetzt, welche alle explosiv wirksam sind und bei der Explosion vollständig in Gasform übergehen.

Bei etwa 50° C. bildet die Sprenggelatine eine syrupartige Flüssigkeit, Wird sie von 60° C. angefangen langsam erhitzt, so explodirt sie bei 204°; wird sie rasch erhitzt, so erfolgt Momentan-Explosion bei 240°, während Guhrdynamit schon bei 180° explodirt.

Setzt man dem Nitroglycerin geringere Mengen Collodiumwolle, circa 2—4 Proc., zu, so gelatinirt es zu einer dickflüssigen Gallerte, welche sich leicht mit salpeterhaltigen, bei der Explosion ebenfalls nahezu vollständig vergasenden Zumischpulvern zu einer plastischen, dem Guhrdynamit im Aussehen ähnlichen Masse, dem sogen. Gelatine-Dynamit mischen lässt.

Die Nobel'schen Gelatine-Dynamite sind aufzufassen als Mischungen aus Sprenggelatine (von etwa $2^1/_2$ Proc. Gehalt an Collodiumwolle) mit einem Zumischpulver aus Salpeter und Cellulose, welches zur Erhaltung der chemischen Stabilität einen geringen Zusatz von Soda erhält.

Es enthält nach Hampe*)

Gelatine-Dynamit I

65 Proc. gelatinirtes Nitroglycerin	97·5 Proc.	Nitroglycerin
	2·5 „	Collodiumwolle
35 „ Zumischpulver	75·0 „	Kalisalpeter
	24·0 „	Cellulose
	1·0 „	Soda

Gelatine-Dynamit II

45 Proc. gelatinirtes Nitroglycerin	97·5 Proc.	Nitroglycerin
	2·5 „	Collodiumwolle
55 „ Zumischpulver	75·0 „	Kalisalpeter
	24·0 „	Cellulose
	1·0 „	Soda.

Der ausserordentlich grosse Vorteil der Gelatinedynamite vor den übrigen Dynamiten mit Aufsaugstoffen besteht darin, dass der Sprenggelatine die Beweglichkeit der kleinsten Teilchen, wie sie das Nitroglycerin besitzt, mangelt. In Folge dessen haben die Gelatinedynamite weit weniger die unangenehmen Eigenschaften des Schwitzens und Abtropfens, als die Dynamite mit flüssigem Nitroglycerin. Die Gelatinedynamite ertragen viel besser die Wirkungen der Wärme, des Druckes und der Erschütterungen auf dem Transporte.

*) „Analyse der Sprengstoffe". Berlin 1883, Ernst u. Korn.

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Die Sprenggelatine besitzt an und für sich genügende Saug- und Absorptionskraft. Es ist deshalb nicht nötig, den Zumischpulvern — wie dies bei den übrigen Dynamiten mit Aufsaugestoffen geschehen muss — einen Ueberschuss an Holzmehl oder Kohle gegenüber dem Salpeter oder einen Zusatz von Kieselguhr zu geben. Die Folge davon ist, dass man bei den Gelatinedynamiten die Verhältnisse der Zumischpulver den zu einer völligen Verbrennung notwendigen möglichst anpassen kann. Die theoretische Dosirung des Zumischpulvers entspricht also der praktisch durchführbaren, was bei den übrigen Dynamiten mit Aufsaugestoffen nicht der Fall ist.

Von Wichtigkeit ist die Eigenschaft der Sprenggelatine, durch Zusätze bestimmter in Nitroglycerin löslicher Stoffe selbst gegen intensive mechanische Einwirkungen in hohem Grade unempfindlich zu werden. Diese von A. Nobel gemachte Beobachtung wurde von Trauzl, Centraldirector der ehemals Nobel'schen Dynamitfabriken weiter verfolgt. Er fand, dass schon ein Zusatz von 4 Proc. Kampher die Sprenggelatine ohne Verlust ihrer übrigen werthvollen Eigenschaften „schusssicher" macht. Erhitzt man eine Sprenggelatine, welche 96 Proc. 10proc. Sprenggelatine und 4 Proc. Kampher enthält, bis auf 300—330° C., so explodirt sie nicht mehr von selbst, sondern verbrennt unter Absprühen. Dies macht die kampherhaltige Sprenggelatine in hohem Grade für militairische Zwecke geeignet und ist sie unter dem Namen „Kriegs-Sprenggelatine" im österreichischen Heere eingeführt.

Alle gelatinirten Sprengmittel können beliebig lange unter Wasser bleiben, ohne Nitroglycerin abzugeben. Ebenso geben sie unter hohem Druck — 1000 kg auf den qcm — noch kein Sprengöl ab.

Während Guhrdynamit auf einem Rammapparate bei einer Stossarbeit von 1 kgm sofort explodirt, ist Sprenggelatine noch bei einer Stossarbeit von 3·5 kgm unempfindlich.

Hinsichtlich der chemischen Stabilität der neuen Nobel'schen Sprengstoffe waren und sind noch teilweise irrige Ansichten verbreitet, welche namentlich auch durch Explosionen auf dem Steinkohlenbergwerke „Rheinpreussen" bei Homburg am Rhein und in der bei Lerbach (Harz) gelegenen Dynamitfabrik Anhänger fanden. Indessen hat ein hierauf bezüglicher Bericht der kgl. technischen Deputation für Handel und Gewerbe in Berlin festgestellt, dass in beiden genannten Fällen die betreffenden Magazine mit Heizvorrichtungen versehen waren, was selbstverständlich als leichtsinnig bezeichnet werden darf. Nach den Versuchen von Hauptmann Hess können die neuen Nobel'schen Sprengstoffe 48 Stunden lang ununterbrochen auf 70° C. erhitzt werden, bis sie Symptome der Zersetzung zeigen. In ähnlicher, günstiger Weise spricht sich Ingenieur H. Münch aus („Die chemische Stabilität der Nitroglycerinpräparate aus den vorm. Alfred Nobel'schen Dynamitfabriken. Oesterr. Zeitschr. f. Berg- u. Hüttenwesen **30**, 384).

b) Kieselguhr-Dynamit. Bis zur Einführung der gelatinirten Nitroglycerinpräparate in die Sprengtechnik nahm der Kieselguhr-Dynamit (bezeichnet als „Dynamit I") weitaus den ersten Rang unter den Explosivstoffen

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ein. Von dieser während eines Jahreszehnts behaupteten Höhe hat er herabsteigen müssen und mit ihm seine Genossen, die Dynamite II, III und IV, welche Gemenge von Salpeter und kohlenstoffhaltigen Körpern (wie Holzmehl) als Aufsauger des Nitroglycerins enthielten. Dynamit II, III und IV werden seit Einführung der GelatineDynamite I und II überhaupt nicht mehr fabricirt. Auch Dynamit I, jetzt einfach Guhr-Dynamit genannt, hat so bedeutend Terrain verloren, dass die Publicationen über ihn in diesem Berichtjahre höchst spärliche im Vergleiche zu früheren Jahren sind.

F. Mauerhofer (Wagner's Jahresber. 1882, 413 aus Vereinsmitt. Beil. z. Oesterr. Zeitschr. f. Berg- und Hüttenwesen 1882, S. 19) berichtet über Versuche mit Dynamit. Werden 28 g Dynamit mittelst Zündschnur und Kapsel zur Explosion gebracht, so explodiren bis auf eine Maximal-Entfernung von 120 mm beliebig grosse Dynamitmassen mit, indem die Luft als explosionsübertragendes Mittel dient. Je grösser die zur Explosion gebrachte Dynamitmenge ist, desto grösser ist auch die Maximal-Entfernung für die durch Lufterschütterung gleichzeitig explodirende Dynamitmasse, wie aus folgender Tabelle hervorgeht.

Gezündete Dynamitmasse	Maximal-Entfernung	Gezündete Dynamitmasse	Maximal-Entfernung
28 g	120 mm	196 g	318 mm
56 „	141 „	224 „	345 „
84 „	177 „	252 „	372 „
112 „	204 „	280 „	403 „
140 „	239 „	308 „	430 „
168 „	278 „	336 „	455 „

Die in Frankreich gültigen Vorschriften über das Lagern von Dynamit teilt D. Murgne (Soc. de l'industr. minér. 1882, S. 30) mit.

c) Dynamit neu No. III. Unter diesem Namen wird jetzt ein Sprengstoff fabricirt, welcher ein mit Nitroglycerin imprägnirtes Sprengpulver von Natronsalpeter, Kohle (resp. Holzmehl) und Schwefel ist. Die procentische Zusammensetzung von Dynamit neu No. III wird verschieden angegeben. Nach Ingenieur Münch besteht der Sprengstoff aus 20 Proc. Nitroglycerin und 80 Proc. Salpeter, Schwefel und Holzmehl im Verhältnisse von 75 : 10 : 15, Nach Göbl (Oest. Zeitschr. f. Berg- und Hüttenwesen 1882, S. 624) enthält Dynamit neu No. III:

Nitroglycerin	12·15
Schwefel	13·19
Natronsalpeter	56·64
Kohle	13·86
Wasser und Verluste . .	4·16.

d) Die übrigen Dynamite. Das Sebastin, welches aus Nitroglycerin, Salpeter und Kohle besteht, wird zu Uddnäs in Schweden fabricirt. Dieser Sprengstoff soll in genanntem Lande ziemlich beliebt sein und wur-

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den von ihm 300 Tonnen während der letzten fünf Jahre in Uddnäs dargestellt. (Wagner's Jahresber. 1882, 413.)

Das Norabin'sche Ammoniakpulver, welches salpetersaures Ammoniak enthält, wird zu Gyttorp bei Nora hergestellt. (Wagner's Jahresber. 1882, 413.)

e) Neue Sprengstoffe. Darstellung von Sprengpapier. (D. P. 21160 vom 20. Juni 1882. Franz Josef Petry in Wien.) Ungeleimtes Papier wird mit einem heissen Gemenge von 17 g gelbem Blutlaugensalz, gelöst in 1500 g Wasser, 17 g Lindenkohle, 35 g raffinirtem Kalisalpeter, 70 g Kaliumchlorat und 10 g mit 50 g Wasser angerührter Weizenstärke bestrichen, getrocknet und geglättet. In Streifen geschnitten wird es zu Patronen gerollt und verwendet. Der patentirte Sprengstoff ist demnach im wesentlichen identisch mit Melland's Schiesspapier. (Vgl. des Verfassers „Explosivstoffe". Wien 1880, S. 200.)

Die neuen Explosivstoffe von Sanlaville und Laligant in Paris (Engl. P. 2488 vom 8. Juni 1881; auch D. P. 19839), welche von den Erfindern „Asphalin" genannt werden, bestehen aus Mischungen, die weder die Neigung haben, chemische Verbindungen unter einander einzugehen (wie Schiesspulver), noch sich chemisch zu zersetzen oder dissociiren (wie Nitroglycerin), welche aber unter dem Einfluss eines Reagens, „Calorigen" genannt, die eine oder andere Eigenschaft erlangen. Für ein Asphalin wird die Formel gegeben: 36·06 Natrium- oder Kaliumbisulfat, 28·60 Kalium- oder Natriumnitrat, 9·20 Glycerin; für das Calorigen gleiche Teile Kaliumchlorat und Kohle. Bei der Entzündung wird Salpetersäure frei, welche mit dem Glycerin Nitroglycerin bildet, das dann die Hauptwirkung hervorbringt. Das kohlenstoffreiche Material wird mit concentrirten Lösungen der Bisulfate, der Nitrate und Chlorate getränkt und dann getrocknet. Dann rührt man die Masse mit Glycerin an und bringt sie in Form von Cartouchen.

Neuerungen in der Zusammensetzung und Herstellung von Schiess- und Sprengpulver. (D. P. 19432 vom 5. April 1882. Carl Himly in Kiel und Louis von Trützschler-Falkenstein in Borkowitz bei Creuzburg.) Salpeter, Kaliumchlorat und ein fester Kohlenwasserstoff (Paraffin, Kautschuk, Guttapercha, Steinkohle, Asphalt, Pech u. s. w.), werden im richtigen stöchiometrischen Verhältnisse für vollkommene Verbrennung mit einander vermischt. Durch Behandlung der Masse mit einem flüssigen, flüchtigen Kohlenwasserstoff, welcher auflösend auf den benutzten festen wirkt, wird eine plastische Masse erzeugt. Diese wird in Plattenform gebracht und durch Abdestilliren des flüchtigen Kohlenwasserstoffes in einen harten Kuchen verwandelt, der zu verschiedenen Korngrössen verarbeitet werden kann. Es können auch die feingepulverten Salze mit der erforderlichen Menge gelösten Kohlenwasserstoffes zu einem plastischen Teig verarbeitet werden, der dann entweder direct gekörnt, oder erst in einen dünnen Kuchen ausgearbeitet und darauf durch Abdampfung des Lösungsmittels getrocknet wird.

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Verfahren zur Herstellung von Sprengstoffen durch directe Nitrirung von Kohlen, Torf und der natürlichen rohen Destillationsproducte derselben. (D. P. 17822 vom 17. Mai 1881; Zusatz-Patent zu No. 12122 vom 3. Juni 1880. Hellhoff in Berlin.) Kohlen, Torf, Pech und Paraffin werden der Einwirkung von stärkster Salpetersäure, Nitraten und Schwefelsäure oder erst schwächerer, dann starker Salpetersäure ausgesetzt und ergeben Nitroproducte, die entweder für sich allein oder mit zugemischten Sauerstoffträgern Explosivstoffe bilden. Die Kohlen werden in feinster Staubform zunächst mit schwächerer Salpetersäure (vom Vol. Gew. 1·4 bis 1·48) behandelt, das in der Säure gelöste Nitroproduct wird getrennt, gewaschen und nun mit concentrirtester Salpetersäure behandelt. Das schliesslich erhaltene Nitroderivat ist in Wasser unlöslich, in Alkohol und concentrirtester Salpetersäure löslich und verbrennt mit Entwickelung von aromatischem Geruch. — Alle erhaltenen Nitroproducte können für sich allein, bezw. in ihren Mischungen mit Sauerstoffträgern durch Zündung zur Detonation gebracht werden.

Herstellung hartkörniger Schiessbaumwolle. (D. P. 18950; Engl. P. 619, 1882; W. F. Reid in Stowmarket.) 100 Volumenteile der in gewöhnlicher Weise gekörnten Nitroverbindung werden mit 50—80 Volumenteilen Aethyl- oder Methylalkohol befeuchtet, getrocknet und dann durch Siebe getrieben. Hierdurch soll das Pulver hartkörnig werden und seine hygroskopischen Eigenschaften verlieren.

Herstellung von Sprengstoffen mit amorphem Phosphor. (Oesterr. P. vom 6. Nov. 1881. B. G. Benedict in Rom.) 2 Tle. amorpher Phosphor werden mit Wasser verrieben, dann 8 Tle. Mennige und 2 Tle. chlorsaures Kali hinzugemischt. Das Gemenge soll statt Knallquecksilber zur Anfertigung von Zündhütchen, Zündpillen u. dgl. verwendet werden. (Wagner's Jahresber. 1882, 404.)

Der Sicherheitssprengstoff von Köppel in Jicin (Oesterr. P. vom 9. Februar 1881) hat folgende Zusammensetzung:

I wird für Sprengungen von hartem Gestein,

II für weichere Gesteine, Kohle u. dgl. angewendet.

	I	II
Kalisalpeter	35·00	42·00
Natronsalpeter	19.00	22·00
Raffinirter Schwefel	11·00	12·50
Sägemehl	9·50	10·00
Chlorsaures Kali	9·50	—
Holzkohle	6·00	7·00
Schwefelsaures Natron	4·25	5·00
Blutlaugensalz	2·25	—
Raffinirter Zucker	2·25	—
Pikrinsäure	1·25	1·50.

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IV. Knallquecksilber.

Die chemische Constitution des Knallquecksilbers. Von E. Carstanjen und A. Ehrenberg. (Journ. prakt. Chem. **25**, S. 232.)

V. Sprengtechnik.

In der Sprengtechnik finden gegenwärtig neben der Sprenggelatine und den Gelatinedynamiten I und II hauptsächlich noch Guhrdynamit und Dynamit neu No. III Anwendung.

Die meisten Mitteilungen über Sprengtechnik beziehen sich in diesem Berichtjahre auf die Erfahrungen, welche man mit Sprenggelatine und Gelatinedynamiten gemacht hat.*)

Nach Moreau wird durch Verwendung der Sprenggelatine eine Minimalersparnis an Handarbeit von 20 Proc. und eine Beschleunigung der Arbeit von 15 Proc. erreicht. Rechnet man die Preisverhältnisse von Sprenggelatine, Guhrdynamit und Schwarzpulver wie 4 : 3 : 1·05, so sind die Preise mit Rücksicht auf die Leistungsfähigkeit des Sprengstoffes:

Sprenggelatine : Guhrdynamit : Schwarzpulver = 1·0 : 1·13 : 1·18.

Es wird also unter sonst ähnlichen Verhältnissen im Richtstollen eines Tunnels die Verwendung des Guhrdynamits 13 Proc., diejenige des Schwarzpulvers 18 Proc. teurer sein als die der Sprenggelatine.

Die Arbeiten am St. Gotthard-Tunnel ergaben unter sonst ähnlichen Verhältnissen und für die gleiche Zahl Cubikmeter Aushub den Verbrauch von Sprenggelatine zu Dynamit wie 1·00 : 1·43, resp. 1·00 : 1·50.

Bei allen Nitroglycerinsprengstoffen, vornehmlich aber bei der Sprenggelatine kommt es auf gute und starke Zündhütchen als erste Bedingung einer vollständigen Explosion und Kraftentwicklung des Sprengstoffes an. Man beziehe die Zündkapseln nur von sehr bewährten Firmen und schütze sie während des Transportes, der Lagerung und besonders des Gebrauches vor Feuchtigkeit. Man wende nur sogenannte verstärkte Zündhütchen an.

Zur Entzündung von Sprenggelatine müssen, wie schon früher erwähnt, Zündpatronen von Gelatine-Dynamit angewendet werden. Die schweizerische Dynamitfabrik Isleten am Vierwaldstädter-See liefert eine fettige, elastische, schwärzliche Füllung zur Zündpatrone für Sprenggelatine von angeblich folgender (gelatine-dynamit-ähnlicher) Zusammensetzung:

56 Proc. Nitroglycerin, 34 Proc. Kalisalz, 6 Proc. Kohle, 4 Proc. Schiessbaumwolle.

Diese Füllung hat sich beim Bau des St. Gotthard-Tunnels gut bewährt.

Für wassersüchtige Bohrlöcher, überhaupt für Sprengungen in oder

*) Die nachfolgenden Mitteilungen über praktische Erfahrungen mit gelatinirten Sprengstoffen sind, wenn keine anderen Quellen angegeben, den beiden Broschüren entnommen: „Die Nobel'schen Nitroglycerinpräparate mit Berücksichtigung der Erfahrungen beim Bahnbau am St. Gotthard." Von L. Tetmayer. Zürich 1882 und „Die Sprengstoffe der Dynamit-Actiengesellschaft vorm. Alfred Nobel & Co. Hamburg". Hamburg 1882.

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unter Wasser, ist einzig und allein Sprenggelatine oder Gelatine-Dynamit zu wählen, da beide im Wasser kein Sprengöl abgeben und ihre volle Wirkung unter Wasser behalten. Die gelatinirten Sprengstoffe können bei Sprengungen unter Wasser in gewöhnliche Leinwandsäcke, Leinwandschläuche, Holzfässchen etc. eingeschlossen werden. Braucht man grössere Ladungen, wie dies z. B. beim Eissprengen, beim Sprengen von Wracks oder bei bedeutenderen Steinsprengungen unter Wasser der Fall ist, so bringt man dieselben am besten in starke Weissblechhülsen, welche bei Anwendung von Guhrdynamit (nicht aber bei Anwendung der gelatinirten Sprengstoffe) wasserdicht verschlossen sein müssen.

Ueber Resultate betriebsmässiger Verwendung der Sprenggelatine wird in der „Zeitschr. f. d. Berg-, Hütten- u. Salinenwesen im preussischen Staate" Bd. XXIX, Heft 3 u. Bd. XXX, Heft 1 berichtet. Nach Versuchen beim Ortsbetriebe im Mansfeld'schen war die Wirkung der Sprenggelatine dem Dynamit gegenüber eine überlegene, die erzielte Leistung eine grössere und der Kostenaufwand, trotz des höheren Preises der Sprenggelatine, im Cubikmeter Gesteinsmasse ein geringerer. Im Durchschnitt rückte das Ort bei einem Querschnitt von 2·2 m Höhe und 2·5 m Weite durch das Abthun von 12 mit Dynamit besetzten Schüssen ebensoweit vor, als durch das Abthun von 9 mit Sprenggelatine besetzten. Als Verhältnis der Wirkung der Sprenggelatine zum Dynamit wurde 10 : 6·83 gefunden. Nach den Versuchen von Director Haber, welche derselbe auf der Abteilung Rambsbeck der Actien-Gesellschaft für Bergbau, Blei- und Zinkfabrikation zu Stolberg und in Westfalen angestellt hat, ist es zweifellos, dass die Sprenggelatine weniger leicht gefriert und leichter wieder auftaut und dass die Gelatinegase weniger unangenehm sind. Letzteres wird auch von L. Tetmayer in seiner oben citirten Broschüre bestätigt. Die Gelatinegase wirken nach ihm zwar beengend und reizen zum Husten, sind aber durchaus erträglich.

Eine neue Art Zündpatronen wurde von Oberst Locher erfunden und mit bestem Erfolge beim Bau des St. Gotthard-Tunnels verwendet. Um das Trennen der Kapseln von den Zündschnüren und das hierdurch herbeigeführte Versagen der Schüsse zu verhüten, wird auf den Boden einer Papierhülse eine Zündpatrone versenkt, der übrige obere Raum aber mit trockenem Sand ausgefüllt. Während der Sandeinfuhr drückt der Arbeiter die Zündschnur gegen die Hülsenwand und bindet schliesslich das vorstehende Papier an die seitlich aufstehende Zündschnur fest.

Beiträge zur Spreng- oder Minentheorie. Von H. Höfer. (Dingl. pol. Journ. **242**, S. 153; **245**, S. 1.)

Verfahren, mit Explosionsstoffen vorzunehmende Sprengarbeiten sicherer zu machen. (D. P. 22006 vom 26. August 1882. Edwin Stanley Clark in Cefn-y-Bedd, Denbigh, England.) Um die bei der Entzündung von Explosionsstoffen in Bohrlöchern sich bildende Flamme und Gase zu verzehren, umgiebt der Erfinder den Sprengstoff im Bohrloch sowol seitlich, wie auch an beiden Enden mit einer Masse, welche aus 90 pCt.

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kryst. Soda, 7 Proc. Kreide, 2 Proc. Mangansuperoxyd und 1 Proc. Seife hergestellt ist. Um das Bohrloch besser mit der Compositionsmasse auskleiden zu können, kann man eine blecherne, unten offene Patronenhülse anwenden und diese zuerst mit der Masse ausfüttern, worauf der Sprengsatz mit Zündschnur eingefügt wird. An einer an dem Deckel der Patronenhülse angebrachten Kette zieht man alsdann die Hülse heraus, bringt noch etwas von der Masse auf den Sprengsatz und das Bohrloch ist zum Schuss fertig gestellt.

Kalkpatrone zum Sprengen von Gestein. (D. P. 19150 vom 2. November 1881. Ch. S. Smith in Leicester und Th. Moore in Shipley.) S. S. 106,

VI. Analyse der Sprengstoffe.

Für die Analyse von Dynamiten empfiehlt G. Lunge das Nitrometer für Säuren oder für Salpeter. Man zieht den Dynamit mit wasserfreiem Aether im Soxhlet'schen Apparat aus und verdunstet den Auszug. Das den Verdunstungsrückstand enthaltende Kölbchen wird gewogen und die nötige Menge Nitroglycerin (höchstens 0·12 g im Nitrometer für Säuren, nicht unter 0·3 g und nicht über 0·35 g im Nitrometer für Salpeter) in den Becher des Nitrometers getropft und zurückgewogen. Hat man zu wenig genommen, so giebt man noch etwas zu; hat man aber schon zu viel eingetropft, so dass das entwickelte Stickoxyd nicht Raum genug haben würde, so wägt man ein kleines Röllchen Filtrirpapier ab, saugt damit etwas Nitroglycerin aus dem Becher des Nitrometers auf und stellt durch eine zweite Wägung des Röllchens die entnommene Menge fest. Hierauf giesst man etwa 2 cbcm conentrirte reine Schwefelsäure in den Becher, saugt diese mit dem Nitroglycerin ein und spült zuerst mit 2, dann mit 1 cbcm Säure nach, worauf geschüttelt wird. Nachdem man 1/4 Stunde stehen liess, wird abgelesen. (Dingl. pol. Journ. **245**, 172.)

Die Analyse der Sprenggelatine erfolgt nach Lunge a. a. O. sehr bequem im Nitrometer. Man löst sie direct im Becher des Nitrometers mit Schwefelsäure auf und ermittelt den Gesamtstickstoffgehalt. In einer anderen Gewichtsmenge zieht man das Nitroglycerin mit wasserfreiem Aether aus und behandelt den Verdunstungsrückstand ebenfalls im Nitrometer. Durch Differenz ergiebt sich hieraus der Stickstoffgehalt der Nitrocellulose.

Die Analyse des Trauzl'schen Dynamits (überhaupt von salpeterhaltigen Dynamiten). Der Trauzl'sche Dynamit besteht aus Nitroglycerin, Cellulose und Salpeter. Er wird nach Lunge (a. a. O.) wie folgt analysirt. Etwa 10 g werden 24 Stunden im Exsiccator stehen gelassen. Durch Rückwägen erfährt man die Feuchtigkeit. Hierauf extrahirt man mit Aether, was am besten geht, wenn man die Substanz in eine cylindrische Düte von Filtrirpapier bringt, die man nach der Extraction herausnimmt, zufaltet und bis zum Verdunsten alles Aethers vor dem Wägen liegen lässt. Vom Verdunstungsrückstand des aetherischen Auszuges wird eine kleine Menge im Nitrometer analysirt. (Gehalt an Rein-Nitroglycerin). Der oben erhaltene

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Rückstand wird im cylinderförmigen Filter selbst in einem dazu passenden Scheidetrichter mit heissem Wasser so lange gewaschen, als das Waschwasser noch Salpeterreaction giebt. Der nunmehr verbleibende Rückstand (Cellulose, zuweilen mit 1—2 Proc. Nitrocellulose) wird zuerst einige Stunden bei 70—80°, dann mindestens 24 Stunden im Exsiccator getrocknet und gewogen. Den Salpetergehalt erfährt man hinreichend genau durch den Gewichtsverlust des mit Aether extrahirten Rückstandes beim Ausziehen mit Wasser.

Die Analyse dreier Sorten Sprenggelatine veröffentlicht W. Göbel. Er fand folgende Zusammensetzung:

	I	II	III
Collodiumwolle . . .	9·99	8·91	9·60
Nitroglycerin	86·78	87·55	87·90
Wasser und Verlust .	3·23	3·54	2·50
	100·00	100·00	100·00

(Wagner's Jahresber. 1882, 412 aus Oesterr. Zeitschr. f. Berg- u. Hüttenwesen 1882, S. 624.)

Ueber die Analyse der Sprengstoffe macht W. Hampe Mitteilungen. Er bespricht zunächst die verschiedenen bisher vorgeschlagenen Methoden zur Bestimmung des Stickstoffgehaltes von Nitroverbindungen, wobei er eingehender bei den Nitrometern von G. Lunge und W. Hempel verweilt. Letzteren Apparat wendet Hampe in einer kleinen Modification an. Alle Explosivstoffe, welche im Nitrometer ausschliesslich Stickoxydgas entwickeln, lassen sich mit dem (modificirten) Hempel'schen Apparate sehr bequem und genau bestimmen. Dagegen eignet sich dieser Apparat nicht für Analyse der Gelatine-Dynamite, da dieselben bekanntlich etwas Soda enthalten, wodurch etwas Kohlensäure in dem zu messenden Gas enthalten ist. Hampe wendet für solche Fälle folgende Methode an: Zerlegen der Substanz mittelst conc. Schwefelsäure und Quecksilber, vollständige Ueberführung der gebildeten Oxydationsproducte des Stickstoffs mittelst Sauerstoffs und Wasserstoffsuperoxyds in Salpetersäure und Bestimmung der letzteren durch Titration mit Natronlauge. Diese Methode, auf deren Einzelheiten hier nicht eingegangen werden kann, eignet sich nach dem Verf. sehr gut zur Stickstoffbestimmung in salpetersauren Salzen und Aethern.

Zum Ausziehen des Nitroglycerins der Sprengstoffe im Soxhlet'schen Apparate wendet Hampe in allen Fällen, wo zugleich auch das Gewicht des Rückstandes ermittelt werden soll, statt des Papiercylinders eine abgesprengte Trichterröhre an, welche oben einen Ring aus Platindraht mit Oese trägt. Dieselbe enthält unten ein kleines Filter aus Glaswatte oder Asbest; die ganze Vorrichtung wird auf einem kleinen Platinstativ stehend abgewogen. Die Trichterröhre fasst bequem 10—12 g Sprenggelatine oder Dynamit. (Sonderabdruck aus der Zeitschr. f. d. Berg-, Hütten- und Salinenwesen im preussischen Staate. Band XXXI.)

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XX. Leucht und Heizstoffe.

A. Leuchtstoffe.

I. Petroleum.

Die Petroleumindustrie Amerika's wird von einem amerikanischen Berichterstatter der Chem. Ztg. (7, 17 und 661) besprochen. Die Existenz des Petroleums in Nord-Amerika soll schon im Jahre 1627 bekannt gewesen sein. Die alten Colonisten fingen schon zu Anfang des vorigen Jahrhunderts das Petroleum mittelst wollener Decken auf, welche über das Wasser ausgebreitet wurden, auf dessen Oberfläche sich eine dünne Oelschicht befand. Diese primitive Gewinnungsmethode wurde noch im Jahre 1850 angewendet. Sie machte sich trotz der spärlichen Ausbeute dennoch bezahlt, weil das Petroleum damals unter dem Namen „Senecaoil" ein geschätztes Heilmittel war, von welchem die Gallone (3·7 l) 1·20 bis 1·50 ℳ kostete. Den ersten artesischen Brunnen für Petroleum bohrte Colonel C. Drake von New-Haven im Jahre 1859. Ende 1860 gab es schon über 200 producirende Brunnen. Ende 1861 wurde der erste fliessende Brunnen aufgefunden, welcher täglich 500 Fässer Oel lieferte. Die Qualität des Oeles ist sehr verschieden. Ein Bohrloch kann ein durchsichtiges Oel von heller Bernsteinfarbe und leichtem spec. Gewicht liefern, während ein anderes Bohrloch eines benachbarten Districtes ein schweres, undurchsichtiges, grünes Oel von unangenehmem Geruch giebt.

Die im Jahre 1870 gegründete Standard Oil Company, deren Vermögen auf 300 000 000 ℳ geschätzt wird, beherrscht den Erdölmarkt. Die Gesellschaft besitzt 20 000 Bohrlöcher, aus welchen das rohe Erdöl durch ein weitverzweigtes Netz von Rohrleitungen nach den Raffinerien und nach der Seeküste geleitet wird.

Das Raffiniren des Oeles wird wie folgt vorgenommen. In grossen stehenden oder liegenden Cylindern aus Stahl oder Kesselblech, welche manchmal 3 000 Fässer Oel bequem fassen, wird das Petroleum bei directer Feuerung fractionirt. Die Destillation wird so lange fortgesetzt, bis etwa 94 Proc. abdestillirt sind. Das Destillat wird gewöhnlich in 4 getrennten Teilen aufgefangen: leichtes Benzin, schweres Benzin, Brennöl und Teer. Das Brennöldestillat wird zuerst mit Schwefelsäure und dann mit Wasser und verdünnter Natronlauge behandelt. Hierauf wird es noch an der Sonne gebleicht und auf seinen Entflammungspunkt geprüft. Letzterer ist im Staate Pennsylvanien 43·3° C., viele Raffinerien bringen jedoch Öele mit dem Entflammungspunkte 50 und selbst bis zu 65 auf den Markt.

Von den 22 000 000 Fässern Petroleum, welche im Jahre 1882 aus den Vereinigten Staaten exportirt wurden, lieferte die Standard Oil Company allein 20 000 000. Diese Gesellschaft versteht es vortrefflich, aber in echt amerikanischer Weise, die öffentliche Meinung und das Parlament für sich

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zu gewinnen. Sie besteht aus einem Dutzend einzelner Gesellschaften und hat man diesen unendlich complicirten Verwaltungsmechanismus aus rein praktischen Gründen (zur besseren Beherrschung des Petroleummarktes und der in die Petroleumdistricte führenden Eisenbahnnetze und Rohrleitungen, aber auch zum besseren Steuerunterschleif) gewählt.

Das Erdölvorkommen in der Argentinischen Republik wird von E. L. Baker besprochen. (Aus Oil and Drug News 1882 S. 11 in Wagner's Jahresber. 1882, 1076.) Das fast schwarze Oel aus der Provinz Jujuy ergab bei der Destillation:

Naphta, von 0·740 spec. Gew.	6
Kerosen, von 0·814	29
Schwere Oele von 0·900	53
Coks	10
Gase	2

Das Erdölvorkommen in Pennsylvanien und New-York. Von H. E. Wrigley (Engin. Mining Journ. 35, 315).

Die russische Erdölindustrie wird eingehend von M. Albrecht (Riga'sche Ind. Zeit. 1882, S. 206 und 219; Wagner's Jahresber. 1882, 1081) besprochen. Die Einführung des amerikanischen Petroleums in Europa vor etwa 20 Jahren gab auch den Anstoss zur lebhaften Entwickelung der Baku'schen Naphtaindustrie. Anfangs war allerdings die Gewinnung der Naphta noch eine sehr primitive. Sie wurde aus flachen Brunnen mit der Hand geschöpft und das gewonnene Oel in Lederschläuchen auf dem Rücken von Kameelen nach den primitiven Destillationen geschafft. Vor 10 Jahren begann man auf der Balachan'schen Fläche bei Baku nach Naphta zu bohren und stiess auf solche colossale Mengen, dass der Preis der Rohnaphta sofort von 45 Kop. das Pud auf 2 Kop., ja eine Zeit lang sogar auf $^1/_2$ Kop. fiel. Die Gewinnung von Rohnaphta pro 1882 wird auf ca. 50 Millionen Pud geschätzt. Nicht weniger als 250 Fabriken beschäftigen sich gegenwärtig mit der Raffinirung der Rohnaphta.

Der Transport der Naphta bot anfänglich grosse Schwierigkeiten. Das Land um Baku herum ist holzarm und musste deshalb das zu den Fässern nöthige Holz und die Reifen aus dem Innern Russlands, die Wolga herunter und über das kaspische Meer bezogen werden. Ebenso langwierig war der Transport der Naphta auf Segelschiffen bis Astrachan und von hier die Wolga hinauf unter zweimaliger Umladung nach Nischny-Nowgorod, wo der Hauptstapelplatz für Petroleum war. Gegenwärtig ist dieses primitive System des Transportes gänzlich verlassen. Die aus den Quellen kommende Rohnapta wird in grossen eisernen Behältern gesammelt und von hier mittelst Dampfpumpen durch eine eiserne Röhrenleitung nach den Fabriken in Tocherny Gorod bei Baku getrieben. Das durch Raffination der Rohnaphta gewonnene Petroleum wird an den Landungsplätzen der Dampfschiffe in eisernen Reservoirs gesammelt und von da direct in die besonders für diesen Zweck construirten Dampfer gepumpt. In Jarizyn an der Wolga ist die

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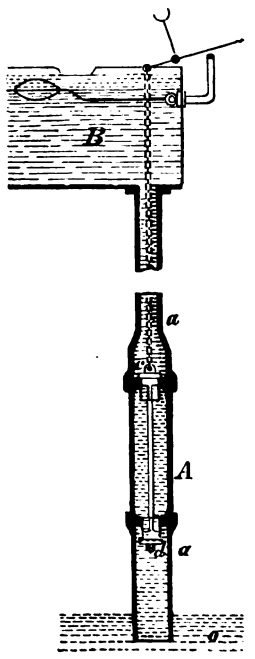
Centralstation für das Baku'sche Petroleum. Es befinden sich dort über ein Dutzend mächtiger Reservoire, aus welchen das Petroleum direct in Cysterne-Waggons gepumpt wird, um von da aus per Eisenbahn den verschiedenen Hauptdepots im Russichen Reiche zugeführt zu werden.

Von Wichtigkeit und Interesse ist auch die Verarbeitung der Naphtarückstände. Sie werden unter Einführung von überhitztem Wasserdampf der fractionirten Destillation unterworfen. Die Destillate werden mit Schwefelsäure und Natronlauge gereinigt. Das wertvollste der hierbei erhaltenen Producte sind die hellen Maschinenöle (0·895—0·915 spec. Gew.), welche wegen ihrer Reinheit, ihrer Consistenz und Unveränderlichkeit mehr und mehr die Vegetabilöle beim Schmieren von Maschinenteilen aller Art verdrängen. Ausserdem erhält man dunkle Maschinenöle für grobe Maschinenteile, Eisenbahnwaggons etc., Cylinderöle, mineralische Maschinenfette, Vaselin, leichtere, hoch raffinirte Mineralöle, Petroleum von hohem Entflammungspunkt, Gasöl und als Destillationsrückstand Naphta-Goudron.

Ueber die Verwendung des natürlichen Gases der Erdölgegenden Amerikas. Anfänglich wurde dieses natürliche Gas, welches man beim Bohren auf Erdöl in Nord-Amerika stets antrifft, zum Heizen der in den Bohrlöchern aufgestellten Dampfkessel benutzt. Gegenwärtig wird das Gas durch Rohrleitungen den nächsten Städten zugeführt. Zwei Gesellschaften, die Keystone Gas-Company und die Bradford Gas Light and Heating Company, versorgen die Städte der Petroleumdistricte mit dem natürlichen Gas. Namentlich die Stadt Bradford gebraucht viel natürliches Petroleumgas. Zum Heizen der Zimmeröfen und Küchenherde hat man brausenartige Vorrichtungen mit vielen kleinen Oeffnungen, welche an die Rohrleitungen befestigt sind. Auch die Städte Wellsburg (West-Virginien) und Pittsburg (Pennsylvania) sollen demnächst mit natürlichem Petroleumgas versorgt werden. Ebenso sind bereits mit Erfolg vereinzelte Versuche gemacht, das Petroleumgas zum Heizen in Eisen- und Stahlwerken zu benutzen. (Chem. Ztg. 7, 169).

Fig. 113.



Verfahren und Apparat zum Heben von Erdölen und anderen Stoffen, welche leichter als Wasser sind. (D. P. 21935 vom 17. October 1882; Fig. 113. Rich. Langensiepen in Buckau-Magdeburg). In das im Schachte stehende Oel *o* taucht eine Röhre *a*, welche mit dem über Tage angeordneten Wasserbehälter *B* in Verbindung steht. Innerhalb der zulässigen Saughöhe ist im Rohre *a* eine Kammer *A* eingeschaltet, deren Boden und Decke durch ein Doppelventil *c d* ab-

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wechselnd geschlossen und geöffnet werden kann. Bewegt man *c d* auf und ab, so wird zuerst die in *a* befindliche Luft von dem schwereren Wasser verdrängt, später das Oel. Letzteres steigt durch *a* in den Behälter *B* und wird hier abgelassen. Statt der einfachen Sitzventile können auch Doppelsitzventile, welche durch eine Röhre mit einander verbunden sind, angewendet werden. Diese Ventileinrichtung bedarf zu ihrer Bewegung einer geringeren Kraftäusserung als die einfachen Sitzventile.

Petroleumgasmaschine. In der „Hannover'schen Actien-Maschinenbau-Gesellschaft" wurden relativ nicht ungünstige Versuche angestellt, welche bei den bekannten Gaskraftmaschinen das Gas durch Petroleum zu ersetzen bezweckten. (Deutsche Ind.-Ztg. 1882, 366.)

Ueber die gesundheitsschädlichen Folgen des Einathmens mit Petroleumdämpfen geschwängerter Luft. (Compt. rend. **96**, 353).

Eine Methode zur schnellen Entdeckung aromatischer Kohlenwasserstoffe in den flüchtigen Erdöldestillaten von G. Gustavson beruht auf der Einwirkung von Brom auf die betreffenden aromatischen Kohlenwasserstoffe bei Gegenwart von Bromaluminium. Etwa 0,01 g Aluminium wird zu 1—2 g Brom, welche sich in einem in Wasser stehenden Probirröhrchen befinden, geworfen. Nach erfolgter Bildung des Bromaluminiums fügt man 1—2 cbcm des zu prüfenden Erdöldestillates hinzu und giesst alsdann den Inhalt des Probirröhrchens auf ein Uhrglas. Bei Gegenwart von aromatischen Kohlenwasserstoffen sind nach dem Verdunsten des überschüssigen Broms und der nicht aromatischen Kohlenwasserstoffe kleine Krystallnadeln sichtbar. Auf diese Weise konnte noch 0,001 g Benzol in 1 cbcm des Destillates scharf nachgewiesen werden.

Ein sparsam brennendes Petroleum soll man nach J. Deutsch in St. Johann a. d. S. (D. P. 17261) dadurch erhalten, dass man 1 l Erdöl mit 4 g Terpentinöl und 2 g Kampher mischt und den Lampendocht mit Talg an seiner Oberfläche 1 mm bestreicht.

Die Versuche L. Liebermann's über den Entflammungspunkt von Petroleum beweisen, dass derselbe abhängig ist von der Petroleummenge und der Entfernung des Zündmittels von der Oberfläche des Petroleums, sowie auch von der Form und Grösse der Apparate. Bei Versuchen, welche in drei Kölbchen von 114,28 und 7·5 cbcm Inhalt ausgeführt wurden, war am Halse der Kölbchen seitlich ein Abflussröhrchen eingeschmolzen; das Petroleum wurde bis zu dieser seitlichen Abflussöffnung in die Kölbchen gefüllt, so dass beim Erwärmen das Niveau constant blieb, indem das der Volumenzunahme entsprechende Erdöl seitlich abfloss. Bei einem Abstande der elektrischen Zündungsdrähte von 6 mm wurde der Entflammungspunkt im grössten Kölbchen zu 25°, im mittelgrossen zu 38° und im kleinsten zu 41° gefunden. Wurden die Zündungsdrähte um 2 mm weiter entfernt, so stiegen die Entflammungstemperaturen auf 28°, 39·5° und 44°.

Um sich von genannten Fehlerquellen unabhängig zu machen, treibt Liebermann durch das von Grad zu Grad erwärmte Petroleum einen Luftstrom

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und hält dabei vor die Oeffnung des Apparates ein brennendes Streichhölzchen. Der von ihm benutzte Apparat besteht aus einem 10 cm hohen und 1·5—2 cm weiten Cylinder, welcher sich unten in eine umgebogene und seitwärts aufsteigende Röhre verjüngt. Diese Röhre ist in ihrer Mitte zu einer Kugel ausgeblasen, während oben ein Gummiballon befestigt ist. Das Oel wird bis zu einer im Cylinder angebrachten Marke eingegossen. Man erwärmt alsdann langsam in einem Wasser- oder Luftbade und treibt von Grad zu Grad mittelst des Gummiballons Luft durch das Petroleum. Ein beständiges Durchleiten von Luft würde den Entflammungspunkt erhöhen, weil es die Ansammlung einer zur Entflammung genügenden Menge entzündlicher Dämpfe erschwert. Zu beachten ist, dass bei elektrischer Zündung wegen der kleinen Wirkungszone des Funkens die Zahlen um 3—4° zu hoch ausfallen. (Zeitschr. anal. Chem. **21**, 321.)

Einen einfachen Apparat zur Prüfung des Petroleums auf Entflammbarkeit beschreibt A. Ehrenberg. (Chem. Ztg. **7**, 599.) Derselbe functionirt durch das Princip der Pumpe und besteht aus zwei weiten Röhren von vernickeltem Messing, welche durch ein engeres Rohrstück mit einander communiciren. Das eine Rohr enthält einen Stempel, welcher bei Beginn des Versuches in die tiefste Lage gebracht wird. Alsdann füllt man Petroleum in das andere Rohr ein und zieht den Stempel bis zu einer an einer an der Stange bemerkten Marke empor. Das Petroleum sinkt in Folge dessen und der von ihm früher eingenommene Raum füllt sich mit Petroleumdämpfen. Man stellt nun das Gefäss in ein Wasserbad, welches man langsam erwärmt. Hat das Petroleum die Temperatur erreicht, bei welcher man die Prüfung beginnen will, so entzündet man ein kleines Zündflämmchen, welches vor der Ausströmungsöffnung des das Petroleum enthaltenden Rohres aufgehängt ist, und drückt den Stempel nieder. Hierdurch wird der über dem Petroleum befindliche Dampf gegen das Zündflämmchen getrieben. Ist die Entflammungstemperatur noch nicht erreicht, so bringt man den Stempel in die frühere Lage und wiederholt die Manipulation, nachdem die Temperatur um 0·2° gestiegen ist.

Nach Leo Liebermann kann ein Petroleum, dessen Entflammungspunkt über 60° liegt, unbedenklich verwendet werden. (Zeitschr. anal. Chem. **21**, 329.)

Ueber die Zusammensetzung des Wassers, welches das kaukasische Erdöl begleitet und von Schlammvulkanen ausgeworfen wird, machte A. Potilitzin der russischen chemischen Gesellschaft Mitteilungen. Charakteristisch für dieses Wasser ist der reiche Gehalt an Jod, Brom und kohlensaurem Natron.

2. Das Steinkohlengas.

a. Erzeugung. Die Gasretortenvorlage *A* (Fig. 114) von August Hagener in Cöln (D. P. 16773 vom 3. Mai 1881) ist hinter dem Ofen und zwar unterhalb der untersten Retortenreihe *C* angeordnet, so dass sich die Destillationsproducte, flüssige wie gasförmige, nur nach unten bewegen. Teer

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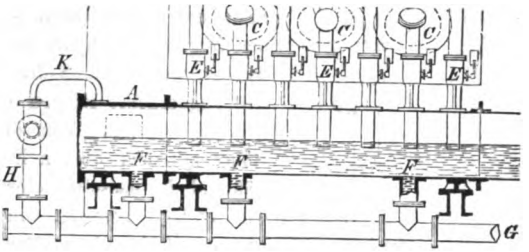
fällt direct in die Vorlage herunter und kommt auch nicht mit dem Gas in Berührung. Letzteres wird durch das Retortenentlastungsventil *E* bewirkt, dessen trockener Verschluss leicht zugänglich ausserhalb der Vorlage liegt und bei welchem der Eintauchstutzen neben dem Ventil angeordnet ist. Damit der Teer in der Vorlage sich nicht verdicke,

Fig. 114.

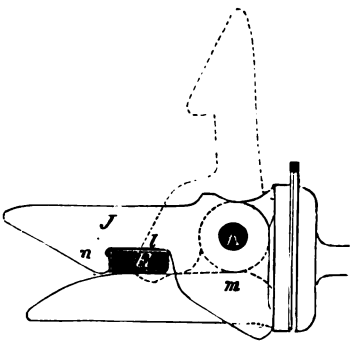


wird derselbe durch Stutzen *F* vom Boden der Vorlage abgeleitet, sammelt sich in dem Rohr *G*, wird in Rohr *H* wieder auf das Niveau der Abpsperrflüssigkeit in der Vorlage geleitet und fliesst dann in ein Teerbassin ab. Damit die Flüssigkeit in Rohr *H* unter demselben Druck erhalten werde wie in der Vorlage, ist dasselbe durch Rohr *K* mit der Vorlage verbunden.

Die gleichzeitige Gewinnung von Leuchtgas und Heizgas durch Fractionirung der Destillation bezweckt das D. P. 14889 von A. Hagener in Cöln. Zu diesem Zwecke erhalten die Retortenöfen zwei getrennte Vorlagen, welche durch Ventile abwechselnd geöffnet oder geschlossen werde nkönnen. Bei Beginn der Destillation, wenn Luft, Kohlensäure, Wasserstoff etc. sich entwickeln und gegen Ende des Processes, wenn sich namentlich auch Schwefelkohlenstoff bildet, gewinnt man das Gas für Heizzwecke. Die inmitten des Destillationsprocesses sich entwickelnden Gase dienen, wie gewöhnlich, als Leuchtgase.

Bei den Retortenmundstücken von Aug. Klönne in Dortmund (D. P. 21083 vom 27. April 1882) wird zum Verschluss des Mundstückes der Bügel *E* gegen die Nase *n* des Arretirhebels *J* gestossen. Wegen der Konicität der Nase *n* schiebt sich Bügel *E* dabei in die Aussparung *l*, so dass der Bügel festsitzt. Mittelst Excenter wird dann der Deckel nachgedrückt, Nach Lösen des letzteren wird der Hebel *J* in die punktirte Lage gebracht, wobei die Nase *m* den Bügel nach vorwärts drückt und so den Deckel abhebt.

Fig. 115.



Ein Apparat zur Druckentlastung der Eintauchröhren in Vorlagen für Retortenöfen zur Gasbereitung (D. P. 21085 vom 5. Mai 1882) von Lieder in Stendal enthält mehrere hydraulische Absper-

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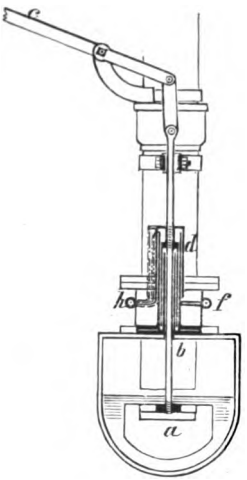
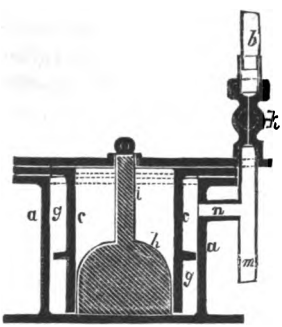
Fig. 116.



rungen der Eintauchröhren bildende Becken *a* in welche seitlich die mit dem Hebel *c* in Verbindung gebrachten Zugstangen *b* eingeschraubt sind. Statt der Stopfbüchsen sind für die Absperrung der Zugstangen hydraulische Verschlüsse *d* angewendet, welche durch drei concentrisch übereinander angebrachte Röhren von entsprechender Höhe gebildet werden. Von diesen sitzt die mittlere Röhre mit dem oberen Ende an den Zugstangen, während die dasselbe einschliessenden unten auf der Vorlage befestigt sind. Um den Stand der Flüssigkeit in diesen Verschlüssen *d* constaut zu erhalten, wird denselben durch einen eventuell continuirlich laufenden durch Rohr *f* zugeführten Wasserstrahl die dem Bedürfnis entsprechende Flüssigkeit zugeführt, während das Rohr *h* das überflüssige Wasser ableitet.

Bei den Druckregulatoren für Gas und Wasser (D. P. 19039 vom 1. November 1881) von Fr. W. Clark in London strömen die Gase oder Flüssigkeiten nicht durch den Apparat, sondern drücken, indem sie durch Zuflussrohr *b*, Hahn *k* und Abflussrohr *m* passiren, vermittelst des Zweigrohres *n* auf das im Raum *g* zwischen den Cylindern *a* und *c* befindliche Quecksilber. Dieses steigt hierdurch im inneren Cylinder *c* und hebt das in diesem befindliche Gewicht *h*, dessen Stange *i* durch einen Hebel mit dem Hahn *k* in Verbindung steht, so dass letztere entsprechend offen gehalten wird. Sinkt der Druck der bei *b* einströmenden Flüssigkeit bezw. des Gases, so senkt sich das Gewicht und in Folge dessen wird der Hahn *k* durch Hebel *i* etwas weiter geöffnet, wodurch der Druck wieder gesteigert wird. Wird kein Gas etc. verbraucht, so wächst der Druck so lange, bis der Hahn gänzlich geschlossen ist.

Fig. 117.



Die Fabrikation von Leuchtgas und Heizgas aus einer Retorte wird nach L. Cohn in Paris (D. P. 17626) in der Weise vorgenommen, dass man über die von der Steinkohlengasbereitung zurückbleibenden Coks Wasserdampf bei Dunkelrotglut leitet, bis ca. 80 Proc. der Coks vergast sind. Alsdann beschickt man die Retorte, ohne den Rest der Coks herauszunehmen, von Neuem mit Steinkohlen und wiederholt den Process.

b. Reinigung. Zellenteervorlage mit warmem Condensator. (D. P. 20845 vom 20. April 1882. Otto Mohr in Dessau.) Die Einrichtung bezweckt bei Teervorlagen die Hauptursache der Teerverdickungen zu be-

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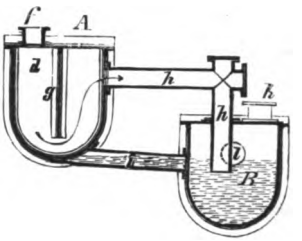
seitigen, indem sie durch Trennung des heissen Teers vom heissen Gase die Abdestillation der leichten Teeröle verhütet. Die Vorlage *A* ist durch Querwände in Zellen *d* geteilt; in jede derselben mündet ein von der Retorte kommendes Rohr *f*. Durch die durchgehende Zwischenwand *g* wird das Gas gezwungen, den durch den Pfeil angedeuteten Weg zu nehmen und tritt durch Rohre *h*, die unter dem Teerniveau der zweiten Vorlage *B* münden, in letztere ein; der Teer gelangt in diese durch die Rohre *i*. Das Gas tritt durch Auslass *k* in einen dicht hinter der Vorlage *B* angeordneten Condensator, der mit verticalen, perforirten Platten versehen ist,

Fig. 118.

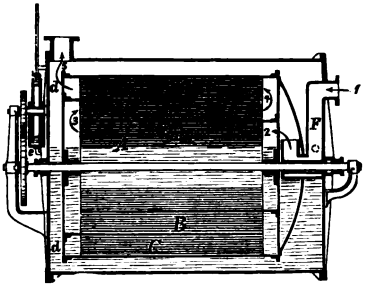


um eine Trennung des im Gase noch befindlichen Teer zu bewirken.

Reinigung von Steinkohlengas. (Engl. P. 5278 vom 2. December 1881. J. Berger Spence und J. Devignes in London.) Das aus den Retorten kommende Gas soll von Ammoniak befreit werden, ohne dass ein Scrubber angewendet wird. Natürliche Thonerdephosphate werden mit Schwefelsäure erhitzt. Das Gemisch von Thonerdesulfat, Phosphorsäure und Schwefelsäure wird mit Kalk oder Magnesit neutralisirt. Mit der getrockneten und zerkleinerten Masse wird ein gewöhnlicher Reinigungsapparat beschickt. Nachdem das Gas hier sein Ammoniak abgegeben hat, kommt es in die Eisenoxyd enthaltenden Reiniger. Die mit Ammoniak gesättigte Thonerdeverbindung kann als Dünger benutzt oder auf Alaun verarbeitet werden.

Bei dem Scrubber von Mohr in Dessau (D. P. 18842 vom 14. Nov. 1881) gelangt das Gas durch *F* (Fig. 119) in der Richtung der Pfeile *1* und *2* in den inneren Cylinder *A* einer rotirenden Trommel. Der Cylinder ist mit concentrischen Ringen ausgefüllt, die dem Gase eine möglichst grosse Berührungsfläche bieten. Auf dem durch Pfeil *3* angedeuteten Wege gelangt hierauf das Gas in den mittleren Cylinder *B*, durchstreicht dort wieder concentrische Ringe und geht dann, wie Pfeil *4* andeutet, in die äussere, gleichfalls mit Ringen ausgefüllte Trommel *C*, welche es durch Oeffnungen *dd* verlässt. Das Wasser tritt bei *e* in den Scrubber.

Fig. 119.



Der Scrubber kann auch in mehrere nebeneinander liegende Kammern geteilt sein, in denen je eine derartig combinirte Trommel rotirt.

Wasserverteiler für Gasscrubber. (D. P. 21785 vom 16. Juli 1882 der Berlin-Anhaltische Maschinenbau-Actiengesellschaft in Dessau.)

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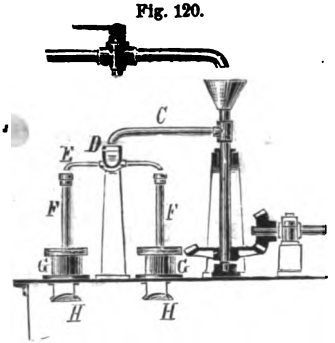
Fig. 120.



Durch das Zuflussrohr *C* wird das Wasser in einen trogartigen Ring *D* geleitet, welcher in mehrere Abteilungen getrennt ist. Jede derselben besitzt einen Ausguss *E* nach einem Rohr *F*, welches das Wasser nach einem syphonartigen, den Gasaustritt verhindernden Kasten *G* führt. Aus letzterem tropft das Wasser behufs Verteilung auf eine Kugelcalotte *H*. Der Auslauf *C* erhält eine stetige langsame Rotation um seine Verticalachse, so dass die Ringabteilungen von *C* intermittirend gefüllt werden und eine gleichmässige Wasserverteilung nach jeder Calotte stattfindet.

Sträubig in Königshütte, Oberschlesien (D. P. 21120 vom 23. Mai 1882) wendet eine grosse Zahl ungelochter Einlagebleche ohne Bewegungsmechanismus, von beliebiger Form und Querschnitt an. Dieselben sind in pultdachförmiger Lage über einander geordnet, so dass das durchströmende Gas gezwungen wird, auf schlangenförmigem längsten Wege das ganze Gefäss zu passiren und das herabfliessende Wasser vielfach zu kreuzen. Durch eingetriebene wellenförmige Vertiefungen wird das herabsickernde Wasser möglichst verteilt.

Der Waschapparat für Leuchtgas und andere Gase von Chevalet in Paris (D. P. 19811 vom 14. März 1882) besteht aus einem Behälter *A*, Fig. 121, in welchem die oben geschlossenen und unten offenen Canäle *B* an-

Fig. 121.

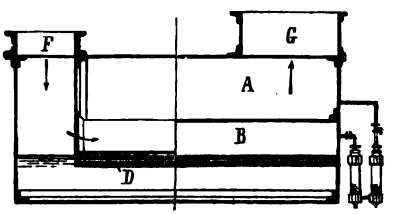
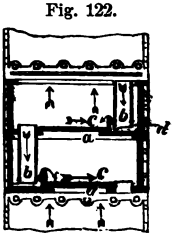


Fig. 122.



geordnet sind. An dem untern Rande der Seitenwände dieser Canäle sind geschlitzte Schienen *D* angebracht, welche in die Waschflüssigkeit tauchen. Die durch Oeffnung *F* eintretenden Gase gelangen zunächst in die Vorkammer; aus dieser gelangen sie, durch die unter Wasser liegenden geschlitzten Schienen dringend, zwischen den Canälen *B* hindurch in den oberen Raum *A*, den sie durch *G* gereinigt verlassen.

Einen zweiten Waschapparat zeigt Fig. 122. Die einzelnen Abteilungen desselben haben durchlöcherte Böden *aa*, auf denen von aussen zugängliche Schieber *cc* angebracht sind. Durch diese kann die passirende, nach aufwärts strömende Gasmenge regulirt werden. Die Ueberlaufrohre *b* in den Ecken der Abteilungen führen das Wasser aus jeder oberen Kammer in ein

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Becken *d* der darunter liegenden, wodurch sich das Reinigungswasser gleichmässig über die durchlöcherten Böden verteilt.

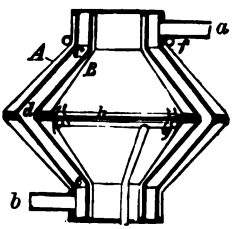
Durch an den Apparaten angebrachte Differenzialmanometer ist der Druck in den einzelnen Kammern von aussen ersichtlich.

Nach L. T. Wright in Beestow (Engl. P. 4133 vom 26. Sept. 1881) wird das mit ein wenig Luft gemischte Gas im Scrubber von Teer befreit, auf 225° erhitzt, dann abgekühlt und über feuchte Tierkohle geleitet.

T. E. Jones in Towerham will das Gas dadurch reinigen, dass er es durch mit Chromsäure getränkte Baumwolle leitet. (Engl. P. 716 vom 14. Februar 1882).

Ein Condensator von Mohr in Dessau (D. P. 19986 vom 20. April 1882) besteht aus den beiden doppelkonoidischen Körpern *A* und *B*, deren Zwischenraum das Gas, bei *a* ein- und bei *b* austretend, passirt. Zur Vermehrung der Oberfläche sind beide Körper mit Rippen versehen.

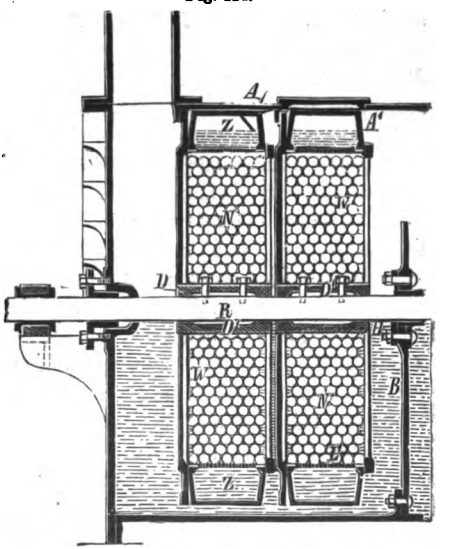
Fig. 123.



Die Geschwindigkeit des Gases vermindert sich von *e* bis *d* und wird von *d* bis *e* wieder erhöht. Da bei *d* die grösste Ringfläche ist, so bewegt sich hier in der Gegend der grössten Condensations-Oberfläche das Gas am langsamsten, ist also intensiver der Wirkung dieser Oberfläche ausgesetzt.

Zur wirksamen Abkühlung der Condensationsflächen sind bei *f* und *g* perforirte Wasserrohrstränge angebracht. Das Blech *h* zwingt die Circulationsluft ihren Weg dicht an der inneren Condensationsfläche zu nehmen und letztere abzukühlen.

Fig. 124.



Gas-Wasch- und Reinigungsapparat (D. P. 20929 vom 14. Juni 1882) von John Laycock und Thomas Clapham in Keighley, Grafschaft York. In dem zum Teil mit Wasser gefüllten Kasten *A*, welcher durch Scheidewände *B* in mehrere Kammern geteilt ist, rotirt die durchgehende Welle R. Letztere trägt die mit porösem Material *N* gefüllten Behälter *W*, deren Seitenwandung durch radiale von den Buchsen *D* ausgehende Arme und dazwischen gespanntes Drahtgeflecht gebildet wird. Diese so gebildeten rotirenden Filtersiebe besitzen an ihrem Umfange die

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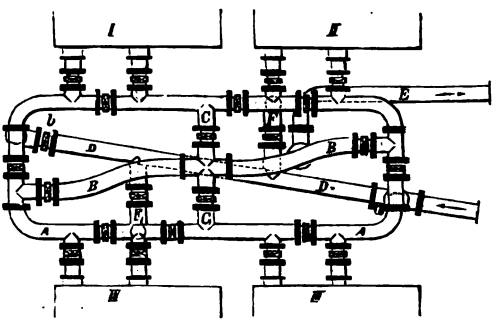
Schöpfkästen Z mit perforirten Böden L. Durch Rotation der Wellen R bezw. der auf ihr sitzenden Filtersiebe wird Wasser aus dem unteren Raum des Apparates gehoben, welches sich dann durch die Oeffnungen der Schöpfkästenböden in die Füllmasse N der Filtersiebe ergiesst und so auf das die letzteren passirende Gas einwirkt bezw. das in diesem befindliche Ammoniak entfernt.

Der Mantel des patentirten Klönne'schen Reinigungsapparates wird nach dem Zusatz- D. P. 20988 unten an der Peripherie durchlocht, so dass das Reinigungsmaterial in einen Wasserverschluss mündet, aus welchem es nach Belieben herausgenommen werden kann.

Wechselvorrichtung für Gasreiniger (D. P. 18171 vom 11. November 1881) von Otto Mohr in Dessau. Der die vier Reinigungskasten I, II, III, IV, Fig. 125, verbindende geschlossene Rohrstrang A und das S förmige Rohr B liegen mit den sie verbindenden Quersträngen C und C^1 in einer Horizontalebene. In gleicher Höhe liegen die Ein- und Ausgänge zu den Kasten. Das Eingangsrohr D und Ausgangsrohr E sind in einer tiefer gelegenen Ebene angeordnet. Das Rohr D ist mit A bei den Schiebern a und b verbunden, ausserdem durch die beiden Querrohre F und F_1. Rohr E ist nur mit Rohr B in Verbindung. In diese Rohrleitung sind 24 Absperrschieber in der dargestellten Weise eingeschaltet, so dass das Gas durch entsprechendes Schliessen und Oeffnen derselben in jeder gewünschten Richtung, Reihenfolge und Combination durch die Apparate streichen kann. Die Schieber können auch durch entsprechende Ventile ersetzt werden.

Fig. 125.



Trocken-Ventilwechsler für Gasanstalten (D. P. 19244 vom 22. Januar 1882) von Friedr. Weck in Berlin. Der für vier Reiniger bestimmte Apparat besitzt in seinem unteren Teil zwei Abteilungen E und A, von denen erstere ein Kreuz bildet. Jede dieser Abteilungen hat vier obere Ventilöffnungen $e_{1,2,3,4}$ bezw. $a_{1,2,3,4}$. Eine jede mündet in den in acht Kammern geteilten mittleren Apparatteil. Dieser Teil hat oben acht correspondirende Oeffnungen, von denen je zwei in den oberen in vier Abteilungen getrennten Teil des Wechslers treten. Der mittlere Apparatteil hat ferner noch acht seitliche Anschlussmuffen $\varepsilon_{1,2,3,4}$ bezw. $\alpha_{1,2,3,4}$. Die vier ersteren sind mit den Kammern verbunden, die unten in das Kreuz E münden, sie bilden die Eingänge zu den Reinigern. Die dazwischen liegenden $\alpha_{1,2,3,4}$, welche unten in den Raum A münden, sind mit den Aus-

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gängen von den Reinigern verbunden. Die vier oberen Abteilungen stellen bei niederstehenden Ventilen die Verbindung zwischen den Ausgängen der Reiniger mit den Eingängen der nächstfolgenden her, während die Ein- und Ausgänge derselben Reiniger unter sich getrennt sind. Das Gas gelangt durch die mit dem Hauptrohr verbundene Muffe E^1 in die Abteilung E und von hier durch ein geöffnetes Ventil z. B. e_1 in die darüber befindliche Kammer des mittleren Teiles und aus letzterer durch die seitliche Muffe ε_1 in den ersten Reiniger. Von hier zurückkommend tritt das Gas durch Muffe a_1 der daneben liegenden Kammer in den Wechsler und durch das unten geöffnete Ventil a_1 in den Raum A, der mit dem Auslass A^1 verbunden ist. Sollen zwei Reiniger in Betrieb gesetzt werden, so stellt man Ventil a_1 tief; das Gas tritt dann in den oberen Verbindungsraum, nachdem es durch den ersten Reiniger gegangen, und nun durch oben offene und unten geschlossene Ventil e_2 in den zweiten Reiniger. Stellt man nun Ventil a_2 hoch, so gelangt das Gas, vom zweiten Reiniger zurückkommend, in den Ausgangsraum A. Dementsprend kann auch der dritte und vierte Reiniger in Betrieb genommen werden. Bei der Einrichtung des Apparates für zwei Reiniger ist ein Durchgangsventil angebracht, womit man die Räume E und A verbinden und das Gas, ohne es durch einen Reiniger zu leiten, durch den Wechsler gehen lassen kann.

Fig. 126.

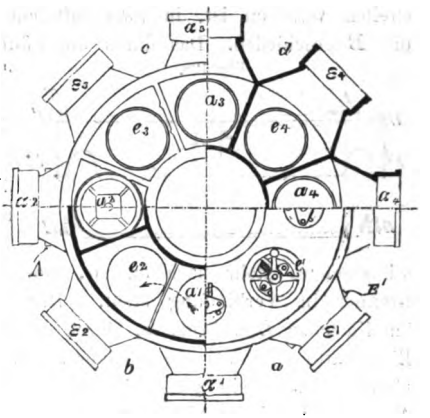
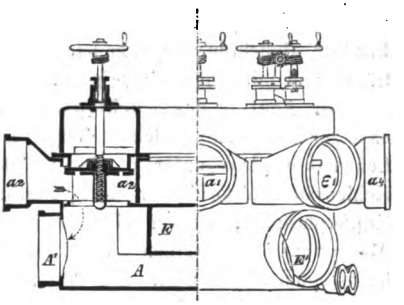


Fig. 127.



c. **Aufbewahrung des Gases.** Bei dem Gasometer mit Bassin von Suckow in Breslau (D. P. 15134 vom 8. Februar 1881) ist in der Gasometerglocke ein von oben bis in das Wasser reichendes Rohr angebracht, welches das Ausströmungsrohr umschliesst und unter der Decke der Glocke dem Gase den Eintritt in letzteres gestattet. Hierdurch strömt das Gas bei der Verwendung immer an der höchsten Stelle aus dem Gasometer in die Rohrleitung ab. Das Gasometerbassin ist durch eine mehrfache Lage von Papier, das mit Teer, Pech und Talg getränkt ist, gedichtet.

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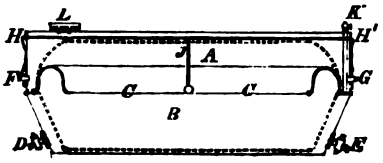
Ein Gasreservoir für mobile Gasbeleuchtung von P. Suckow und Kuppisch in Breslau (D. P. 20115 vom 24. Februar 1882) ist durch eine bewegliche Eisenplatte *C*, welche mit einem ringsherum laufenden Lederstreifen versehen ist, in zwei luftdicht von einander getrennte Räume *A* und *B* geschieden. Das durch die Füllhähne *D* und *E* einströmende Gas drückt nach Oeffnen der Luft-Auslassöffnungen *F* und *G* die Eisenplatte *C* in die Höhe und schliesslich bei vollständiger Füllung gegen die obere Gehäusewand. Aus dem mit Gas gefüllten Unterkasten *B* führt ein durch Hahn *K* abzuschliessendes Rohr nach aussen, welches mit der vorhandenen Zahl der Brenner in Verbindung steht. Der abgeschlossene Oberkasten besitzt im Kästchen *L* Luftzulässe, durch welche Luft in dem Maasse über die Eisenplatte tritt, als die Brenner aus dem Unterkasten *B* Gas consumiren: hierdurch wird ein gleichmässiges Senken der Platte *C* beim Brennen und Aufheben etwaiger Stösse bezweckt. Um jederzeit die Füllung im Kasten *B* erkennen zu lassen, ist ein durch Platte *C* beeinflusstes Hebel- und Zeigerwerk *HH'I* angeordnet, welches den Stand der Platte *C* von aussen anzeigt. Das zur Abdichtung angewendete Leder der Platte *C* wird mit Paraffinöl getränkt und mit Kohle eingerieben.

Fig. 128.



d. Analyse des Leuchtgases. L. T. Wright macht darauf aufmerksam dass zur Bestimmung kleiner Mengen Schwefelwasserstoff und Kohlensäure im Leuchtgase nicht unter 0·5 bis 1 Cubikfuss Gas anzuwenden seien. Die Kohlensäure absorbirt er durch Natronkalk, den Schwefelwasserstoff durch Kupferphosphat, dessen eigentümliche Bereitungsweise er angiebt. Als Absorptionsröhren werden die bekannten Muencke'schen U-Röhren mit Glashahnstopfen angewendet. Zur Absorption des Schwefelwasserstoffs füllt man in den einen Schenkel eines solchen Absorptionsrohres Kupferphosphat, in den anderen Chlorcalcium, während man die untere Biegung zweckmässig mit Baumwolle ausfüllt. Das Gas muss, wenn es die das Kupferphosphat enthaltende U-Röhre passirt, von Ammoniak frei sein, da letzteres vom Chlorcalcium absorbirt würde. Zur Absorption des Ammoniaks dient ein U-Rohr, welches mit dickflüssiger Phosphorsäure getränkte Bimssteinstücke enthält. (Journ. Chem. Soc. 247 S. 267, Chem. Ztg. **7**, 819.)

Knublauch hat die bekannte Valentin'sche Methode zur Bestimmung von Schwefel im Leuchtgase bedeutend vereinfacht. Statt des Platinrohres benutzt er ein gewöhnliches Glasrohr. Das Platinnetz ist durch Platinasbest ersetzt. Die Menge des die gebildete Schwefelsäure absorbirenden kohlensauren Kalis und der mit dem Gase gemischten Luft ist verringert. Den Zähler und die Absorptionsapparate zum Trocknen der Luft erspart Knublauch dadurch, dass er feuchte Luft anwendet und dieselbe unter constantem Drucke ausströmen lässt. (Zeitschr. anal. Chem. **21**, 335.)

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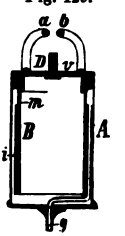
e. Eigenschaften des Leuchtgases. Ueber Vergiftung mit Leuchtgas. Von M. von Pettenkofer. Eintretende Rohrbrüche einer Gasleitung, welche sich unter der Strasse befindet, können der Nachbarschaft und zwar namentlich im Winter gefährlich werden. Wie durch von Pettenkofer angestellte Versuche bewiesen ist, wirkt im Winter das Innere der Häuser schornsteinartig ansaugend auf Grundluft und Kellerluft. Nach Max Gräber ist die untere Grenze für einen schädlichen Gehalt der Athemluft an Kohlenoxyd 0.6—0.7 pro mille. Bei einem Gehalt von 1.5 pro mille zeigen sich bereits entschiedene Krankheitssymptome, die sich bei 2—3.5 pro mille steigern, ohne geradezu tödtlich zu werden, selbst, wenn solche Luft viele Stunden lang geathmet wird. Steigt der Gehalt an Kohlenoxyd auf 4—5 pro mille, dann erfolgt rasch tödtliche Vergiftung. Bei einem in München stattgehabten Unglücksfalle wurde die Luft eines 28 cbm fassenden Zimmers durch 1.44 cbm Steinkohlengas auf einen Gehalt von 5 pro mille Kohlenoxyd gebracht. (Ber. Akad. München 1883, 247.)

3. Carburirtes Gas.

a. Carburirtes Leuchtgas.

H. Vale in Hamburg hat seinen Carburirapparat verbessert. (D. P. 19012)*) In dem zur Aufnahme des Naphtalins bestimmten Messingbehälter *A*, Fig. 129, ist ein Kupfercylinder *B* befestigt, welcher vermittelst der durch den Brenner *D* erhitzten Kupferstangen *a* und *b* bezw. des konisch eingeschliffenen Deckels *v* die Wärme hinableitet und somit das Naphtalin zum Schmelzen bringt. Das durch Rohr *g* einströmende Gas bestreicht einen um *B* gelegten mit dem geschmolzenen Naphtalin getränkten Docht *i* und gelangt durch Oeffnung *m* in den Kupfercylinder *B* und zum Brenner *D*.

Fig. 129.



Bei einer anderen Ausführung des Apparats wird die Stärke der Carburirung durch einen unter dem Naphtalinbehälter befindlichen Hahn der Zuleitung derart regulirt, dass man das Gas durch entsprechende Drehung des Hahnkükens entweder vollständig oder nur zum Teil durch den Carburator streichen lässt, wobei sich im letzteren Falle das carburirte Gas vor dem Eintritt in das Brennerrohr mit nicht carburirtem Gase mischt. Die Füllschraube des Carburir-Gefässes bildet hierbei einen doppelten Verschluss, indem ausser dem durch das Gewinde hergestellten für diesen Zweck noch ein Bleipfropfen durch eine kleine Schraube in der Füllkappe befestigt ist, welcher sich beim Zuschrauben in die innere Oeffnung des Gewindes am Apparat einpresst und fest anlegt.

Bei dem Apparat (Fig. 130 und 131) wird das Verdampfen des Naphtalins durch ein Rohr *H* und das vorgewärmte Gas bewirkt. Das bei *A* eintretende Gas wird in der Vorkammer *V* durch die Leuchtflammen vorgewärmt und gelangt dann durch Rohr *B* in den Hahn *C*, welcher es je nach seiner

*) Techn. chem. Jahrb. 1882, S. 171.

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Stellung durch Rohr *D* (Fig. 131), das ausserhalb des Wärmeleitungsrohres *H* steht, oder durch *E* innerhalb desselben, oder durch beide führt, so dass das Gas entweder carburirt, oder, ohne das Naphtalin zu passiren, zum Teil oder ganz dem Brenner zugeführt wird. Bei einer Modification ist zur Vorwärmung des Gases und Erwärmung der Kupferröhre *H* eine besondere oberhalb des Behälter brennende Heizflamme angebracht.

Fig. 130.

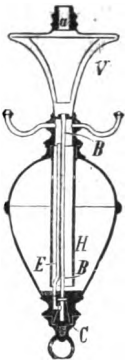
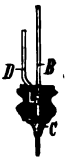


Fig. 131.



Verfahren und Einrichtung zur Carburirung von comprimirtem Steinkohlengas für Beleuchtung von Eisenbahnwagen. (D. P. 19521 vom 23. Nov. 1881, von L. A. Riedinger in Augsburg.) Das Gas wird zunächst in einem mit Aetzkalk gefüllten Raume getrocknet und hierauf behufs vollständiger Ausscheidung aller condensirbaren Bestandteile stark comprimirt. Das vollkommen trockene, comprimirte, in Reservoiren gesammelte Gas wird nach Passirung eines Hochdruck-Reductionsapparates in einen Carburator geleitet und aus diesem den Lampen zugeführt.

Fig. 132.

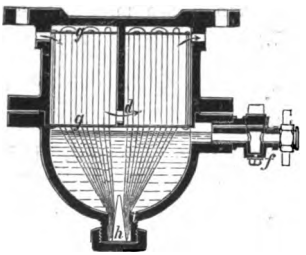
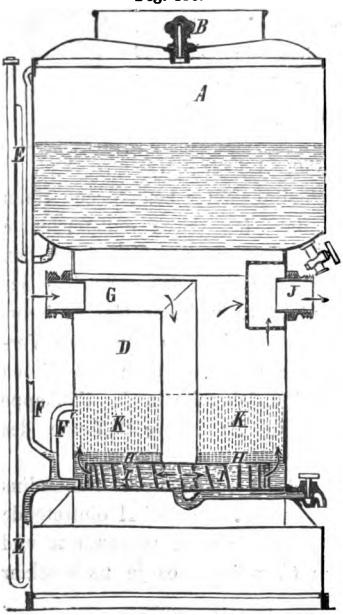


Fig. 133.



Der zur Anwendung kommende Carburator, Fig. 132, besteht in seinem oberen Teil aus zwei Kammern, die durch eine Oeffnung *d* verbunden sind, so dass das Gas in der Richtung der Pfeile den Carburator passiren muss. In diesem sind durch Scheiben *g g* gezogene Dochte gespannt, welche als Flüssigkeitsverteiler dienen und unten zusammenlaufend durch den Stopfen *h* gehalten werden. Zur richtigen Füllung des Carburators ist der Füllhahn *f* desselben oben mit einem kleinen Luftcanal versehen, der gleichzeitig mit der Füllbohrung durch einen Konus geöffnet bezw. geschlossen wird.

b. Carburirte Luft.

Der Luftcarburator von Lascols in Paris (D. P. 17495 vom 5. Juni 1881) besteht aus einem durch heberartige Speise- und Communicationsrohre *EFF*$_1$, Fig. 133,

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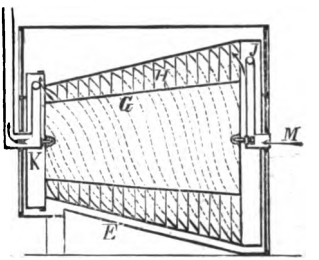
behufs continuirlicher und automatischer Speisung mit dem Reservoir *A* verbundenen Behälter *D*, in welchem die Luft, durch Rohr *G* eintretend, unter eine Schaufelscheibe *HI* gelangt, hier die Carburirflüssigkeit in Circulation versetzt und sich dadurch innig mit derselben sättigt. Die carburirte Luft passirt dann zum Zweck der Reinigung das feine Sieb *K* und entweicht hierauf durch *J*. Zur Anreicherung von Leuchtgas wird der Apparat in der Weise modificirt, dass das Reservoir *A* aus mehreren übereinanderliegenden Etagen besteht, die durch Rohrstutzen unter sich und durch Heberrohre mit dem Behälter *D* communiciren, um eine vollkommene Gleichmässigkeit der Speisung und des Druckes im Apparat zu erzielen.

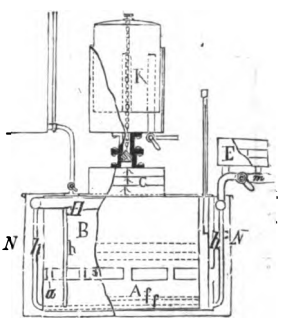
Nach Vigreux in Boisguilleaume (D. P. 20853 vom 18. Juni 1882) rotirt in einem mit geeigneter Flüssigkeit gefüllten Behälter *E* der geschlossene Konus *G*, welcher von den spiralförmigen Zügen *H* umgeben ist. Letztere stehen einerseits mit dem Raum *J* und durch diesen mit der äusseren Luft in Verbindung; andererseits ist eine Kammer *K* angeordnet, welche die carburirte Luft aufnimmt und mit dem Abzugsrohr *N* in Verbindung steht. Bei der Rotation des Konus wird die durch Rohr *M* eintretende Luft durch die spiralförmigen Züge successive nach vorwärts gedrückt und in innige Berührung mit der Flüssigkeit gebracht, um dann carburirt in die Kammer *K* und durch Rohr *N* zu entweichen.

Fig. 134.



Wittamer in Antwerpen (D. P. 18248) hat einen selbsttätig functionirenden Apparat construirt. Die Luft wird mittelst einer direct wirkenden calorischen Luftpumpe zunächst in eine Glocke gedrückt, aus welcher dieselbe, nach Erfordernis zuvor den Reinigungs-Apparat *E* passirend, in den Carburator gelangt. Ersterer ist luftdicht verschlossen und besitzt mehrere die Reinigungsmasse tragende Metallsiebe, durch welche die Luft strömen muss. Das Rohr *m* führt die Luft zum Carburator, welcher aus drei etagenförmig angeordneten Cylindern *A*, *B* und *C* besteht, die von einem Mantel *N* umgeben sind. Die Cylinder *A* und *B* sind durch oben und unten offene Rohre *a* verbunden; ersterer sowie ein Teil von *B* nehmen den flüssigen Kohlenwasserstoff auf. Die durch Rohr *m* zugeführte Luft tritt in das grössere, den Cylinder *B* umgebende Kupferrohr *H* und aus diesem durch die Rohre *h*, welche mit feinen Oeffnungen am Boden des Cylinders *A* münden, in letzteren in sehr feinen Stralen ein, steigt die perforirten

Fig. 135.



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Blechböden *ff* passirend empor und gelangt so in Leuchtgas verwandelt in den oberen Teil des Cylinders *B*. Dort stösst sie sich, weiter emporsteigend, wiederum gegen Platten *pp* des oberen Cylinders *C*, wodurch die flüssigen Partikelchen abgesondert werden. Nunmehr gelangt die carburirte Luft vollständig trocken und von allen condensirbaren Dämpfen befreit in den Regulator *K*.

Um einen vollkommen regelmässigen Betrieb des Apparates, selbst während des strengsten Frostes, zu sichern, wird ein Regulir-Thermometer angeordnet, welches auf geeignete Weise mit einem Gasofen in Verbindung steht, der unter den Mantel *N* gestellt wird und der dazu dient, die Wärme des Wasserbades, in welchem der Carburator steht, zu reguliren.

4. Gasbrenner und Apparate zum Reguliren, Zünden und Löschen von Gasflammen.

Bei Hirzel's rauchlos brennendem Argandbrenner (D. P. 20086 vom 12. Mai 1882) wird die Gasmenge für die gewünschte Flammengrösse mittelst des Ventilkegels *k* mit Gewinde *f* und Hebel *g* regulirt. Die atmosphärische Luft tritt durch *l* und *o* von aussen zu, passirt den Zwischenraum *r* und gelangt, mit dem Gas vereinigt, welches aus der Oeffnung *n* tritt, durch den einen grossen Canal *u* nach dem eigentlichen Brenner. Die eigentümliche Form des Ventilkegels *k* hat den Zweck, das Rauschen und Brausen des Gases zu verhindern. Dies ist dadurch erreicht, dass der Querschnitt des Gascanales, von der engsten Stelle beim Ventilsitz *i* an, sich ganz allmälig noch oben erweitert, so dass das Gas schliesslich bei *n* mit sehr geringem Druck austritt. Der Luftzutritt ins Innere der Flamme ist durch das Sieb *L* bedeckt, um die Flamme gegen Zug unempfindlicher zu machen. Zur bequemen Reinigung kann das Sieb *L* um das Suchräubchen *m* auf die Seite gedreht werden.

Fig. 136.

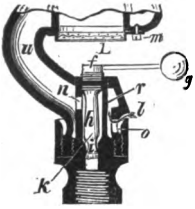
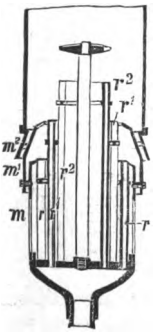


Fig. 137.



Fr. Siemens hat seinen „Multiplicirten Stralenbrenner" verbessert. (D. P. 18884 vom 7. Januar 1882.) Um einen möglichst grossen Lichteffect auf einen Brennapparat zu concentriren, werden dem einen Kranze *r* von Gasausströmungsröhrchen des Stralenbrenners (D. P. 10484) noch mehrere Gasrohrkränze r_1 r_2 in der Art hinzugefügt, dass die Röhrchen des innersten Kranzes r_2 die längsten sind, während sie nach aussen hin immer kürzer werden. Mehrere einander concentrisch umschliessende Mäntel m m_1 m_2, welche mehrere freie Räume zum Lufteintritt bilden, umgeben die Röhren.

Ein Gas-Rundbrenner von Michel in Nürnberg besteht aus den

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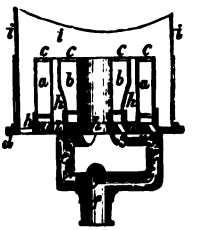
ringförmigen Kammern *a* und *b* mit den radialen Austrittsschlitzen *cc*. *d* ist ein für alle Kammern gemeinschaftlicher Boden, an welchem sich drei knieförmige Röhren *eee* befinden, die sich unten in das gemeinschaftliche Rohr *f* vereinigen. Das Gas strömt durch die drei Röhren und die Oeffnungen *gg* im Boden in die beiden Kammern *a* und *b*; die Verbrennungsluft tritt durch die ringförmigen Zwischenräume *hh* zwischen den Kammern und Glascylinder *i* zu. (D. P. 19801.)

Fig. 138.



E. Schwarzer in Düsseldorf hat einen Gasbrenner mit keilförmigem Schnitt patentirt (D. P. 17757 vom 23. September 1881).

Fig. 139

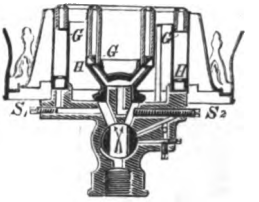
Bei dem Brenner von Lewis in Safe Harbour (D. P. 18166 vom 15. October 1881), Fig. 139, wird der Gasstrom durch das Rohr *b*, der Luftstrom durch Rohr a_2 nach dem Rohr a_1 geführt. Die aus a_1 brennende Flamme schlägt durch die auf das Rohrende aufgesetzte Haube *a* aus Platindrahtgaze und bringt diese zum Glühen. Durch diese Vorrichtung soll auch das Entweichen unverbrannter schädlicher Gase verhütet werden.

Fig. 140.

A. Deschel in Berlin (D. P. 18989 vom 22. Januar 1882) wendet zwei oder mehrere combinirte Rund- oder Flachbrenneran, von denen jeder für sich durch Schrauben S_1 bezw. S_2 regulirbar ist. Der in Fig. 140 gezeigte Brenner ist derart eingerichtet, dass nicht nur die beiden einzelnen Flammen durch die Schrauben S_1 S_2 regulirt werden können und also der Neigungswinkel der beiden Brenner bezw. Flammen gegen einander durch eine Rohrschelle *R* regulirbar ist, sondern dass man auch willkürlich eine oder die andere Flamme durch entsprechende Drehung des Kahnkükens *H* löschen kann. Fig. 142 zeigt einen Rundbrenner, bei welchem durch Schraube S_1 die Gaszuführung für den äusseren Brenner und durch Schraube S_2 diejenige für den inneren Brenner eingestellt werden kann; auch ist dieser Rundbrenner mit einer Zündvorrichtung verbunden. Um den Druck des Gases möglichst zu reduciren und letzteres gleichmässig zu vertheilen, sind die Brennergehäuse unten mit einem zweiten Speicksteinbrenner oder einem perforirten Metallring *H* versehen, während unmittelbar neben dem eigentlichen Brennerring ein zweites Gazenetz *G* angebracht ist.

Fig. 141.

Fig. 142.



Bei dem Brenner von Hearington in London (D. P. 21093 vom 13. Juni 1882) steht die um Mischrohr *b* angeordnete Kammer *e* mit ersterem durch

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Oeffnungen *ff* in Verbindung; auf dem Rohr *b*, Fig. 143, befindet sich die unten durch Drahtgaze *g* abgeschlossene Kappe *h*, in welche das Gas- und Luftgemisch durch *b* eindringt und aus deren Drahtgaze *g* dasselbe herausbrennt. Im oberen Teil der Kammer *e* befindet sich ferner ein Kranz verticaler Rohre *kk*, durch welche gleichfalls ein Teil des Gas- und Luftgemisches heraustritt und mit der aus dem Drahtgewebe *h* heraustretenden Mischung zusammentrifft und sich entzündet. Die so vereinigte Heizflamme breitet sich um die Kappe *h* aus, auf der die zu erhitzenden Vorrichtungen stehen.

Fig. 143.

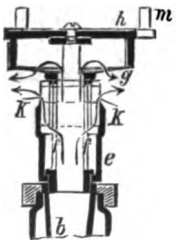
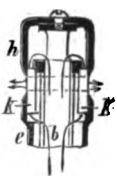
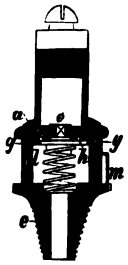


Fig. 144.



Soll der Brenner für Leuchtzwecke dienen, so wird nur Gas verwendet; der niedersteigende Teil des Gasstromes tritt dann statt durch Drahtgaze ebenfalls durch die Röhrchen *kk* aus, wie die Pfeile der Fig. 144 zeigen. Bei einer dritten Ausführung werden für beide Flammen durchlöcherte Bleche oder Drahtgaze verwendet und ist die Construction hier entsprechend modificirt.

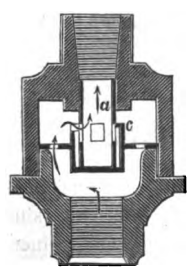
Fig. 145.



Bei dem Regulator für Brenner von A. Michel (D. P. 21113 vom 22. April 1882) besitzt der auf die Zuleitung geschraubte Unterteil *e* in seiner Decke *g* Oeffnungen *h*, welche mittelst einer durch den drehbaren Oberteil *a* beeinflussten und durch Spiralfeder *l* angedrückten eigenartig geformten Scheibe dem gewünschten Gasdurchlass entsprechend verdeckt werden können. Die Aussenseite von *a* trägt eine Scala, an welche der Zeiger *m* des Unterteils *e* beim Offenstehen einer Oeffnung auf dem Teilstrich 1, bei 2 Oeffnungen auf 2 u. s. w. steht.

Flürscheim in Gaggenan, Baden, hat seinen Gasconsumregulator folgendermaassen eingerichtet (D. P. 19439).*) Der Gasconsum wird durch einen auf dem Rohr *a* gleitenden Cylinder *c* regulirt, Fig. 146. Dieser Cylinder ist so weit, dass seine Wandungen die von *c* nicht berühren; die Führung wird durch nach innen abgebogene Kanten oder Führungsspitzen des Cylinders *c* gesichert. Die Regulirung des Gasabflusses wird entweder direct durch Abschliessung der Ausströmungsöffnungen durch die Cylinderkanten, oder durch Annäherung des oberen Cylinderrandes an die Regulatorwandung, oder auch durch beides gemeinsam bewirkt. Auch kann der innere Cylinder beweglich, der äussere stabil sein. Bei einer anderen Modification ist in das unten offene Rohr *c* ein zweites in dem Unterteil sitzendes Rohr

Fig. 146.



*) Techn.-chem. Jahrb. 1883, S. 132.

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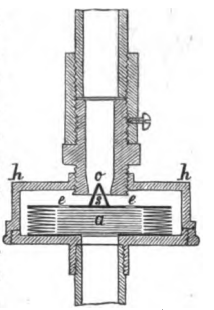
geschoben, dessen Querschnitt durch eine Schraube von aussen regulirt werden kann. Rohr *a* hat ferner eine horizontale Scheidewand und seitliche Oeffnungen über und unter derselben. Das Gas tritt aus den unteren Oeffnungen, so wie damit correspondirenden des Rohrstutzens *c* in das Regulator-Gehäuse und aus diesem durch die über der Scheidewand befindlichen Oeffnungen von *a* zum Brenner. Seitliche Bohrungen des Unterteils gestatten dem Gas den Zutritt unter die volle Schwimmerscheibe.

Bei dem Regulator von Parsy in Lille (D. P. 20854 vom 20. Juni 1882) steigt das durch Leitungsrohr *T* eintretende Gas zwischen dem äusseren Gefäss *A* und dem auf *T* ruhenden Becken *C* in die Höhe und gelangt durch Oeffnung *o* des mit dem Deckel verbundenen unten offenen Cylinders *D*, der den Schwimmer *F* aufnimmt, zum Brenner. Hierbei drückt das Gas auf die im Becken *C* bezw. im Cylinder *D* befindliche Flüssigkeit so dass der Schwimmer *F* durch den Druck des über ihm befindlichen Gases beeinflusst, stets in entsprechender Höhe gehalten wird, wodurch dessen Konus *k* die Austrittsöffnung mehr oder weniger schliesst. Der Querschnitt der Ausströmungsöffnung verkleinert sich somit, wenn der Druck des Gases zunimmt und umgekehrt. Durch Tiefereinschrauben des Rohres *T* wird gleichzeitig das Becken *C* gehoben, wodurch der Wasserspiegel bezw. der Schwimmer steigt, so dass man den Consum des Gases variiren lassen kann.

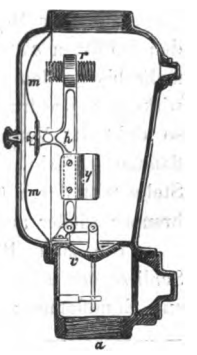
Fig. 147.

Fig. 148.



Das Wesentliche eines Regulators von F. Siemens (D. P. 18825) bildet die Anordnung einer elastischen Druckkammer *a* in dem Gehäuse *h*, welche aus dünnen Blechringen und zwei stärkeren Böden derart zusammengelötet ist, dass ein leicht ausdehnbarer Raum gebildet wird. In diese Druckkammer tritt das Gas direct aus der Leitung und dann durch kleine in dem oberen Boden angeordnete Oeffnungen *e e* in den freien Raum der Hülse *a*, um dann durch die Oeffnung *o*, deren Weite mittelst des auf der Druckkammer befestigten Konus *s* regulirt werden kann, zum Brenner zu gelangen.

Fig. 149.



Am Regulator von Ueckel in Augsburg (D. P. 21793) ist das Ventil *v*, Fig. 149, mit einer durch den Verbrennungsdruck belasteten Membran *m* mittelst eines Hebels *h* in der Weise verbunden, dass die an letzterem fest bezw. beweglich angebrachten Belastungsgewichte *g* und *r* um so kräftiger wirken, je mehr sich das Ventil von seinem Sitz entfernt.

Gasdruck-Regulator (D. P. 19814 vom 16. März 1882) von A. Wagner in Chemnitz.

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Westphal in Frankfurt a. M. hat seinen pneumatischen Gasanzünder*) folgendermaassen eingerichtet (D. P. 19190). Das unter die Membran *a* gelangende Gas tritt durch das Speiserohr *k* der Zündflamme aus dem Zündbrenner oben hinaus, schlägt, hier entzündet, auf den Zündbrenner zurück und brennt dort als centrale Zündflamme *O* weiter. Wenn der Druck in der Zuleitung sich steigert, bis die Membran *a* und damit das Ventil *H* gehoben wer den kann, so löst sich letzteres von seinem schrägen Sitz und es tritt Gas in dasselbe und von hier unter die zweite Mem bran *b*. Während des Stillstands des Ventils gelangt das Gas durch Canal *w* und Röhre *D* in den Brenner *M* und durch Canal *i* in die Zündröhre *E*, tritt bei *n* in die Zündflamme *O*, entzündet von hier das aus den Löchern *o o* der Zündröhre *E* austretende und weiter das aus dem Brenner *M* entweichende Gas, so dass nunmehr die Leuchtflamme brennt. Durch den inzwischen ausgeglichenen Druck gegen Membran *b* wird das Ventil *H* völlig gehoben; die aufgeschliffenen Ventilflächen schliessen dabei die Oeffnungen *r* der Ventilführung und bewirken das Verlöschen der Zündflamme *O* und *n*.

Fig. 151.

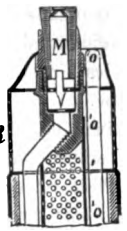
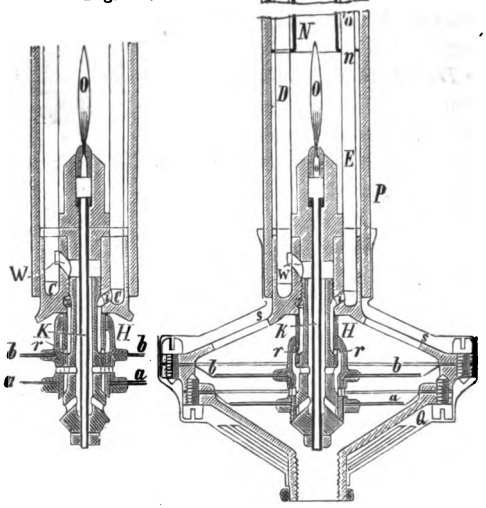


Fig. 150.



Das über Membran *b* befindlich gewesene Luftquantum ist hierbei aus den Schlitzen *s s* des Unterteiles herausgedrückt. Das Ventil *H* wird nunmehr bis zu dem gewünschten Löschdruck durch den auf die Membran *b* wirkenden Gasdruck in der Höhe gehalten. Wird der Löschdruck erreicht, so sinkt das Ventil langsam auf seinen unteren Sitz zurück und die Leuchtflamme erlöscht. Das im Ventil befindliche Gas entweicht und an seine Stelle tritt durch Oeffnungen *o n* und *r* Luft ein, welche aus dem Leuchtbrenner wieder austretend das Gas vollends aus dem Ventil entfernt.

Die zum Brennen der Zündflamme notwendige Luft tritt durch Schlitze der unteren Schutzhülle *Q* in diese und von hier in das Bougie *P* zur Zündflamme; die Verbrennungsproducte entweichen aus den oberen

*) Techn.-chem. Jahrb. 1882, S. 177.

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Bohrungen des Schutzrohres *N* bezw. aus den seitlichen Oeffnungen der Bougiehaube *R*, ohne die Hauptflamme zu stören.

Die Anwendung der Zündvorrichtung kann auch bei einem Argandbrenner geschehen; in diesem Falle wird die Zündflamme aus einem kleinen centralen Bunsenbrenner gespeist. In der Mitte des Argandbrenners ist ein Glasrohr angeordnet, welches in eine Abzugsschutzhaube ragt. Die Verbrennungsgase der Zündflamme erhalten dies Glasrohr heiss und bewirken einen beständigen starken Zug in der Abzugsschutzschraube, welcher einen äusseren Cylinder für die Leuchtflamme entbehrlich macht.

H. Schütze in Lüben hat eine selbstthätige Heizvorrichtung zur Verhinderung des Einfrierens der Gaslaternen (D. P. 18814 vom 29. November 1881) construirt.

5. Apparate zur Erzeugung eines intensiven Lichtes.

C. Clamond in Paris hat sein Verfahren*) verbessert. (D. P. 21205.) Das System der Verteilung von Luft und Gas besteht hier, abweichend vom Hauptpatent, aus vier über einander liegenden Scheiben *V U Q Y*, von

Fig. 152.

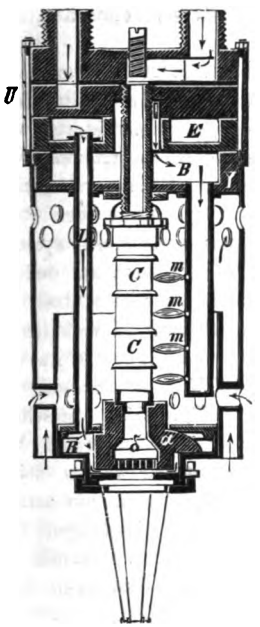
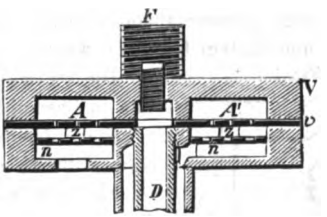


Fig. 153.



denen die beiden unteren kreisförmige Kammern *E* und *B* bilden. Kammer *B* liefert das Gasgemenge den Wärmflammen *m*, während Kammer *E* ein Gas- und Luftgemenge durch Röhren *L* der Sammelkammer *R* zuführt, ausder es zur Verbrennung mit der im Rohr *C* vorgewärmten Luft gelangt. Die Luft tritt hierbei durch die Bodenöffnungen *δδ* eines Thonstückes *a* zur Flamme, Fig. 152.

Die beiden Scheiben *V* und *U* besitzen je zwei cylindrische, auf einander passende Kammern *A* und A_1; die der Scheibe *U* stehen durch je einen regulirbaren Canal mit dem Gaseintritt *F* in Verbindung; ebenso correspondiren die Kammern der Scheibe *V* mit dem Lufteintritt *D*. Diese halbkreisförmigen Canäle der Scheiben *V* und *U* nehmen beim Aufeinanderliegen der letzteren eine symmetrische Lage ein und bilden so getrennte

*) Vgl. Techn.-chem. Jahrb. 1883, S. 134.

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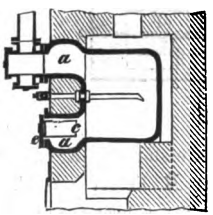
Wege für den Zufluss von Gas und Luft nach den Kammern *A* und A_1. Hier erfolgt eine innige Mischung. Eine durchbohrte Platte *v* trennt die Kammern *A* und A_1 in je zwei Abteilungen; die Luft gelangt in die obere Abteilung der Kammer, strömt durch Löcher der Platte *v* und trifft das durch *s* eintretende Gas. Dies Gemisch gelangt dann durch Löcher einer zweiten Scheidewand *n* in die unteren Abteilungen und von hier in die Kammern *E* und *B*. Der früher gebrauchte Platindrahtkorb zur Aufnahme des Magnesiakorbes ist durch einfache Längsdrähte ersetzt, um letzteren leichter gleiten lassen zu können, wenn es in Folge der hohen Temperatur seiner Lage gegen das Platindrahtgestell verändert.

6. Oelgas.

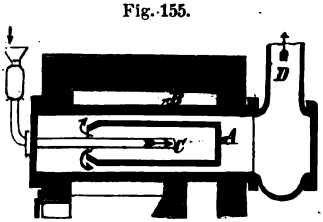
Die Anwendung des bei der Paraffinfabrikation aus Braunkohlenschiefern als Nebenproduct abfallenden Paraffinöles zur Leuchtgasbereitung wird namentlich in Fabriken eine immer häufigere. Bekanntlich ist Halle und Umgebung das Centrum der deutschen Paraffinfabrikation. Die von dort gelieferten Paraffinöle zeichnen sich durch ein relativ hohes Rendement von Leuchtgas aus. Die Paraffinölgasfabrikation eignet sich vorzüglich für Fabriken und sonstige grössere Etablissements, da sie mit relativ sehr einfachen Apparaten und Mitteln betrieben werden kann.

Fig. 154.



Die Oelgas-Retorte (D. P. 20124) von Drescher in Chemnitz, Fig. 154, ist im Querschnitt höher als weiter, ähnelt somit einer stehenden Retorte, wird jedoch seitlich geöffnet. Die Retorte besitzt zwei seitlich abgehende Stutzen *a a*, deren oberer der Abgangsstutzen der Gase, während der untere der Putzstutzen ist. Beide Stutzen sind vollkommen symmetrisch, so dass die Retorte gedreht bezw. auf beiden Seiten benutzt werden kann. Der untere Stutzen hat an seinem Deckel *e* eine blinde Wand *c*, um die Abkühlung zu verhüten.

Fig. 155.



Ein Einsatzstück für Oelgasretorten (D. P. 18955) hat Schmidt in Chemnitz patentirt, Fig. 155. Demselben wird das Oel durch Rohr *C* zugeführt. Die sich bildenden Oeldämpfe werden durch dieses Einsatzstück gezwungen, nur unmittelbar an den heissen Wandungen der Retortenwandung entlang zu streichen, so dass ihre Zersetzung eine vollkommenere wird. Die Gase entweichen dann durch Rohr *D*.

Ein Apparat zur Reinigung von Kohlenwasserstoffgasen (D. P. 18249 vom 16. September 1881) von Ch. Cl. Walker zu Lilleshall, Salop und W. Th. Walker in Highgate, besteht aus einer Reihe von Metallbehältern *C*, welche die Form von umgekehrten Trögen haben und die an

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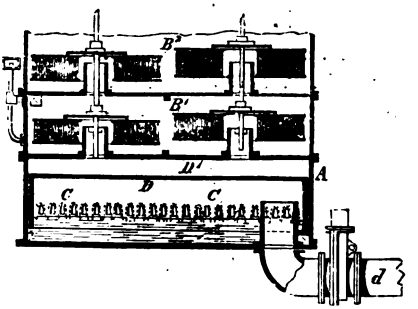
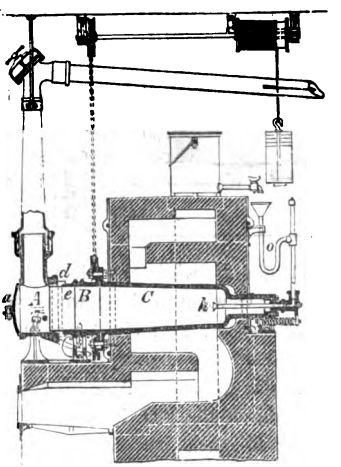
ihrer unteren Seite mit Schlitzen versehen sind. Die äusseren Stirnseiten dieser Behälter sind geschlossen, während ihre inneren Stirnseiten mit dem Behälter *D*, an welchem die Tröge befestigt sind, durch Oeffnungen in Verbindung stehen. Der so gebildete Waschapparat steht so tief in einer ammoniakalischen oder anderen reinigenden Flüssigkeit, dass die Schlitze vollkommen eintauchen. Das durch Rohr *d* in den Behälter *D* eintretende Gas gelangt durch die Oeffnungen, durch welche die Tröge *C* mit *D* mit einander in Verbindung stehen, in erstere und dringt durch deren Schlitze in den mit D_1 bezeichneten Raum, so dass Teer und andere Destillationsproducte abgesondert werden, ehe das Gas die Scrubber B_1 und B_2 erreicht. — Ein solcher Waschapparat wird auch getrennt vom Scrubber angewendet.

Fig. 156.



R. Schwartz in Egestorf bei Hannover hat einen Ofen mit rotirender Retorte zur Erzeugung von Leuchtgas aus flüssigen Oelen (D. P. 17507) angegeben. Die Retorte besteht aus dem conischen Rumpf *C* (welcher den sich allein im Feuer befindlichen und auszuwechselnden Teil bildet) und dem mit diesem verschraubten Retortenhals *B*, der durch den Retortenkopf *A* abgeschlossen ist. Die verschraubten Teile *B* und *C* sind auf je einem ausserhalb des Feuers liegenden Rollenpaar gelagert, von denen sich das vordere zur Führung der Retorte in einer entsprechenden Rille bewegt, während das hintere eine Längsausdehnung der Retorte gestattet. Der Retortenkopf *A* ist durch einen selbstdichtenden Deckelverschluss *a* geschlossen und nach dem Retortenhals *B* zu durch eine Stahlmanschette *d* hermetisch abgedichtet, welche die Rotation der Teile *B* und *C* gegen den feststehenden Teil *A* gestattet. Zum Schutz der Manschette ist in den Retortenhals ein Blechring *e* eingefügt. Die Retorte wird durch eine endlose Kette in Umdrehung versetzt. Das Oel tritt durch ein Syphonrohr *o* und Einlaufrohr *h* in den hinteren sich verjüngenden Teil der Retorte ein. Beim Auftreffen auf die innere Wandung der Retorte wird es einesteils der Conicität und andernteils der Rotation der Retorte folgen.

Fig. 157.



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so dass dasselbe den Weg einer conischen Spirale beschreibt und ihm mithin stets neue Vergasungsflächen dargeboten werden.

7. Gas aus verschiedenen anderen Materialien.

Neuerungen an Apparaten für Hydro-Oxygengasbeleuchtung (D. P. 17786 vom 21. Juni 1881) von Wilhelm Wolters & Sohn in Wien. Der Gasbehälter *A* dient zur Aufnahme von Wasserstoffgas oder

Fig. 158.

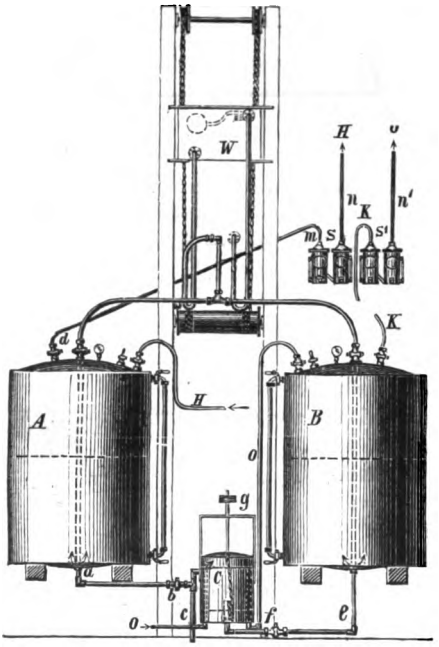
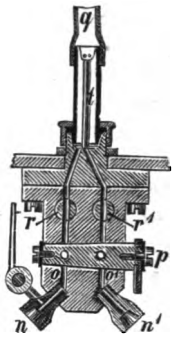


Fig. 159.



Leuchtgas, Behälter *B* zur Aufnahme von Sauerstoffgas. Der Behälter *A* wird durch Rohr *H* mit Gas gefüllt. Das Wasser wird aus demselben durch die Rohrleitung *a*, *b*, *c* fortgeführt. Zur Fortleitung des Gases dient die Leitung von *d* nach *m*, wo dasselbe einen Sicherheitsapparat passirt, um dann durch Rohr *n* weitergeführt zu werden. Der Behälter *B* wird aus dem Regulirungsgasometer *C* gefüllt, dessen Glocke durch Gewicht *g* beschwert wird. Sobald diese Glocke eine gewisse Höhe erreicht hat, wird ein Ventil *v* geöffnet, und infolge dessen tritt das Wasser aus dem Gasbehälter *B* durch Rohrleitung *ef* in den Behälter *C* und fliesst von da durch das Ableitungsrohr *c* ab. Infolge dessen tritt das Sauerstoffgas durch Rohr *O* in den Behälter *B*. Aus diesem geht dasselbe durch Rohr *K* nach der Sicherheits-Vorrichtung und weiter zum Beleuchtungsapparat. Behufs Herstellung eines gleichmässig auf den Gasinhalt der Behälter *A* und *B* wirkenden Druckes ist mit letzteren ein verstellbares Wasserreservoir *W* in Verbindung gebracht.

Die Sicherheitsvorrichtungen *S* und S^1 bestehen je aus zwei Blechgefässen, die durch ein Rohr mit einander verbunden sind. Oben besitzt jedes Gefäss ein nach abwärts sich öffnendes Ventil mit Schwimmerkugel.

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Das Gas tritt in das erstere Gefäss durch Leitung *m* bezw. *k*, passirt die offenen Ventile, drückt das im Gefäss befindliche Wasser durch die Verbindungsrohre zum Teil in das zweite Gefäss und gelangt durch das offene Ventil des letzteren zum Beleuchtungsapparat. Diese Sicherheits-Vorrichtungen verhindern eine rückgängige Bewegung der Gase und verhüten, dass das Wasser in die Rohrleitungen *n* und n^1 gelangt.

Sie münden in die Bohrungen *o* und o^1 eines Metallstückes (Fig. 159) mit Hahn *p*. Letzterer besitzt zwei Bohrungen, durch welche sowol die Wasserstoff-, als auch die Sauerstoffleitung zu gleicher Zeit geöffnet bezw. geschlossen werden kann. Um bei etwaigem Undichtwerden des Hahnkükens *p* eine Mischung beider Gasarten zu verhindern, besitzt letzteres in der Mitte seines Umfanges eine kleine Nut, die mit einem Loch des Gehäuses correspondirt. Die Hähne *r* und *r'* reguliren den Zufluss der beiden Gasarten. Von dem der Leitung *n* zweigt sich ein kleines Rohr für die Zündflamme ab. Das Wasserstoffgas gelangt durch Canal *o* in eine Röhre, welche durch ein perforirtes Körbchen abgeschlossen ist und von hier durch die Oeffnungen desselben in die Mitte des Mischungsrohres *q*, welches in eine Kupferdüse für die Ausströmung des Gasgemisches endigt. Das Sauerstoffgas tritt durch Canal *o'* in das Rohr *t* und von hier in den Mischungsraum *q*. Durch das ausströmende und entzündete Hydro-Oxygengasgemisch wird ein verstellbarer Kalkcylinder oder dergleichen zum Erglühen gebracht. Das Sauerstoffgas wird in einem geneigt liegenden Rohr, welches auf beiden Seiten durch Deckel verschlossen ist, durch Erhitzung erzeugt; der eine Deckel trägt ein Sicherheitsventil und das Gasableitungsrohr, welches in eine Waschflasche mündet. Das Sauerstoff entwickelnde Material wird entweder in Kuchenform gepresst und, mit einem Lehm- oder Manganoxydüberzug versehen, um das Anhaften an die Retorte zu verhindern, direct in das Retortenrohr eingeführt, oder es wird dasselbe in Blechrinnen geschüttet, die dann in ersteres eingesetzt und nach erfolgter Ausnutzung des Materials mit dem verbleibenden Rückstande wieder herausgezogen werden.

8. Paraffin und Erdwachs.

Ueber die Ozokeritindustrie mit besonderer Berücksichtigung der in den letzten Jahren gemachten Fortschritte berichtet E. Sauerlandt (Chem. Ztg. VII. 372 und 388). Ausser Boryslaw sind noch Truskawiec, Dwiniacz und Starunia, sämtlich in Ost-Galizien gelegen, als Erdwachslieferanten zu erwähnen. In dem eine Meile von Boryslaw entfernten Badeorte Truskawiec wurden schon in geringer Tiefe Erdwachslager angefahren, aus denen bisher schon einige Tausend Centner Ozokerit gewonnen wurden. Das Wachs ist schwefelhaltig und müssen die daraus bei der Paraffinfabrikation fallenden Oele unter besonderen Cautelen verarbeitet werden.

In Boryslaw, bekanntlich dem Hauptfundorte von Erdwachs, befindet sich die Mehrzahl der Schächte im Besitze von drei grösseren Gesellschaften, von welchen die älteste, die „Französische Erdwachs- und Petroleum-Gesell-

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schaft", schon seit Jahren besteht, während die „Lemberger Creditbank" und das Consortium „Gartenberg, Lieberмann & Co." erst im vergangenen Jahre durch Ankauf zahlreicher Schächte ihre Unternehmungen constituirt haben.

Die Preise stiegen von 25 ö. fl. im Mai 1882 wieder stetig auf 31·50 fl., bei welcher Notirung sie jetzt noch beharren. Da bei solchen Preisen der Nutzen der Erdwachs verarbeitenden Fabriken ein sehr fraglicher ist, so haben schon mehrere Etablissements statt des Erdwachses amerikanische Paraffinschuppen in grossen Quantitäten bezogen und dabei gute Rechnung gefunden.

Die mit dem Erdwachs geförderte und „Lep" genannte Gangart wird durch Umschmelzen von dem grössten Teil des Ozokerits befreit. Immerhin aber enthalten die verbleibenden Rückstände bis zu 12 Proc. Erdwachs. Im vergangenen Jahre ist es J. Merz in Boryslaw-Wolanka gelungen, mit seinen in den meisten Ländern patentirten Extractionsapparaten die Erdwachsrückstände zu verarbeiten. Von dem geförderten Erdwachs wird etwa ein Drittel auf Paraffin und zwei Drittel auf Ceresin verarbeitet.

Die Verwendung des Erdwachses zur Paraffinfabrikation hat besonders in Galizien zugenommen und ist auch hier die Destillation mit überhitztem Wasserdampf allgemein angenommen. Ein grosser Teil des in Galizien fabricirten Paraffins wird im Lande selbst zur Herstellung der den jüdischen Bewohnern notwendigen Sabbathkerzen verwendet und zu diesem Zwecke nicht so sorgfältig als sonst gereinigt. Das erhaltene Destillat wird vielmehr, ohne es zu pressen, direct mit rauchender Schwefelsäure raffinirt. Das hierbei resultirende Paraffin ist zwar nicht ölfrei, aber von ziemlich weisser Farbe.

Auf dem Gebiete der Paraffinreinigung sind aus letzter Zeit zwei Patente zu erwähnen. Das in 1881 E. van Haecht und J. Schreier erteilte Patent für Paraffinreinigung (Abblasen der verunreinigenden Oele durch erhitzten Dampf*) ist nur verwendbar bei Paraffinen, welche als Verunreinigung von specifisch leichten Oelen begleitet sind, wie es bei sorgfältiger Destillation bei dem ersten Teile des Wachsdestillates, welcher das im Erdwachs als solches gebildete Paraffin enthält, der Fall ist. Dagegen ist diese Methode nicht anwendbar für die später übergehenden Destillate, welche die durch Destillation der im Erdwachse sich findenden Harze gewonnenen Paraffine enthalten.

Das zweite der erwähnten Patente nahm Ujhely im Jahre 1881 auf Raffiniren und Härten des Paraffins. Das Rohparaffin wird mit einem Gemisch von Petroleum-Benzin und einem Alkohol (Methyl-, Aethyl- oder Amylalkohol) zusammengeschmolzen und nach dem langsamen Erkalten gepresst. Durch den Zusatz von Alkohol wird die Löslichkeit des Paraffins bedeutend verringert und hierdurch ein an Paraffin ärmeres Pressöl gewonnen.

Was die Ausbeute von Parraffin betrifft, so ist dieselbe in den letzten Jahren durch Einführung der Destillation mit überhitztem Dampf bedeutend gesteigert worden. Sie beträgt jetzt bei Verarbeitung eines zur Paraffinfabrikation geeigneten Wachses 60—70 Proc. (vor kurzer Zeit noch 36 bis 50 Proc.!)

*) Techn.-chem. Jahrb. 1883, S. 140.

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In der Ceresinfabrikation sind die Hauptverbesserungen bei der möglichst lucrativen Aufarbeitung der Rückstände gemacht. Man unterscheidet zwei Methoden der Ceresindarstellung. Nach der einen (einfacheren) wird das Erdwachs mit englischer und mit rauchender Schwefelsäure so lange bis auf 200° erhitzt, bis der grösste Teil der Säure durch Zersetzung und Verdampfung entfernt ist. Hierauf behandelt man das Erdwachs bei geeigneter Temperatur mit neutralisirenden und entfärbenden Mitteln, wie Thonerde, Silicaten, Spodium, Salzpulver der Blutlaugensalzfabriken. Bei der zweiten Methode werden die Harze und färbenden Bestandteile des Erdwachses ebenfalls durch Säure, aber bei verhältnismässig niedriger Temperatur entfernt und wird dabei eine so tiefgreifende Zersetzung wie bei der erstgenannten Methode vermieden.

Die Anwendung der Schwefelsäure als harzzerstörendes Mittel bei der Ceresinfabrikation hat man bis jetzt noch nicht zu entbehren gelernt. Es wurden zwar verschiedene Patente auf eine „Bleichung des Erdwachses" ohne Hilfe von Schwefelsäure genommen. Das Erdwachs soll nach diesen Patenten in Benzin gelöst, die Lösung durch Knochenkohle filtrirt und aus dem Filtrate durch Abblasen das Lösungsmittel entfernt werden. Der Ausführung dieser anscheinend recht guten Methode stellten sich jedoch grosse praktische Schwierigkeiten entgegen. Selbst wenn diese Schwierigkeiten überwunden würden und der Verbrauch an Entfärbungsmitteln auf ein Minimum reducirt würde, wäre der Gehalt dieses „gebleichten Erdwachses" an sauerstoffhaltigen Harzen, welche durch die Behandlung mit Schwefelsäure zerstört werden, ein entschiedenes Hindernis für die Anwendung des Fabrikates als selbstständiges Beleuchtungsmaterial.

Ueber die specifischen Gewichte von Paraffin und Ceresin macht E. Sauerlandt (Chem. Ztg. 7, 388) eine beachtenswerte Bemerkung. Das specifische Gewicht bei den Substanzen differirt je nach den verschiedenen Erstarrungspunkten. So bewegt sich das specifische Gewicht von Paraffin in den Grenzen von 0·869 für 38-grädiges bis 0·943 für 82-grädiges. Die specifischen Gewichte von Ozokerit-Paraffin sind bei einem Erstarrungspunkte von 56° 0·912, von 61° 0·922, von 67° 0·927, von 72° 0·935, von 76° 0·939, von 82° 0·943. Ebenso sind die specifischen Gewichte von Ceresin und Ozokerit je nach den Erstarrungspunkten verschieden.

Ueber die Identität der Braunkohlenparaffine mit den künstlichen Normalparaffinen von F. Krafft (Chem. Ztg. 7, 153). Wie Krafft und Lützelschwab fanden, sind die synthetischen Methanhomologen identisch mit den aus dem Braunkohlenparaffin durch Destillation unter stark vermindertem Drucke gewonnenen Paraffinen.

Ein nach vorhergehendem Erweichen bei 52—54° schmelzendes Braunkohlenparaffin wurde einer wiederholten systematischen, mit Krystallisationen aus Aetherweingeist und Aether combinirten Fractionirung unterworfen, zuerst aus kupfernen, schliesslich aus gläsernen, im Metallbade erhitzten Retorten und zwar unter consequenter Benutzung eines stark verminderten

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Druckes, wodurch jede Veränderung der der Destillation unterworfenen Substanz ausgeschlossen wurde. Auf diese Weise wurden aus den tiefer siedenden Anteilen des Paraffins die Kohlenwasserstoffe $C^{22}H^{46}$ und $C^{24}H^{50}$ abgeschieden, welchen sich die weiteren Homologen $C^{26}H^{54}$ und $C^{28}H^{58}$ anreihten, deren Identificirung als „normale" Substanzen ebenfalls mit Hilfe der aus der früheren Tabelle für diese Reihe durch Interpolation berechneten Eigenschaften unschwer erfolgen konnte. Die Identität der so erhaltenen Braunkohlenparaffine mit den synthetischen Normalparaffinen (D. chem. Ges. Ber. 15, 1687—1727) geht aufs deutlichste aus folgender Tabelle hervor:

I. Aus Braunkohlenparaffin isolirt.

	$C^{22}H^{46}$	$C^{24}H^{50}$	$C^{26}H^{54}$	$C^{28}H^{58}$
Schmelzpunkt	43—44°	50—51°	55·5—56°	60—61°
Spec. Gew., eben geschm. .	0·7778	0·7786	0·7792	0·7793
Siedepunkt unter 15 mm .	224—226°	243—245°	261—263°	279—281°

II. Künstliche Normalparaffine.

Schmelzpunkt	44·4°	51·1°	ca. 57°	ca. 61·5°
Spec. Gew., eben geschm. .	0·7782	0·7786	ca. 0·7790	ca. 0·7796
Siedepunkt unter 15 mm .	224·5°	243°	ca. 261°	ca. 279°.

Man erhält von jedem dieser vier Körper eine zwischen 8 und 12 Proc. variirende Ausbeute, zusammen etwa 40 Proc. des Ausgangsmaterials.

B. Heizstoffe.

1. Holz.

Um Holz gegen Feuchtigkeit zu schützen, bestreicht es B. Bavink in Leer (D. P. 16727) mit einer Mischung aus 5 Tln. erhitztem Terpentin, 10 Tln. Harz und 1 Tl. Sägemehl.

Die Imprägnirung des Grubenholzes mit Eisenvitriol wird von Landsberg (Wochenschr. d. Ver. deutsch. Ingenieure 1882, S. 91) empfohlen.

Zur Kenntnis der Holzsubstanz. Von M. Singer (Monatshefte für Chemie 1882, S. 395). Verf. hat versucht, jene chem. Verbindungen, welche man unter dem Collectivnamen Lignin zusammenfasst, aus dem Holze durch wochenlang fortgesetzte Behandlung mit kochendem Wasser zu extrahiren. Bemerkenswert ist, dass reines Vanillin mit den Holzstoffreagentien (schwefelsaurem Anilin, Phloroglucin, Indol, Pyrol) die für die Verholzung charakteristischen Färbungen erzeugt. Verf. schliesst hieraus, dass jener Stoff, welcher im Holze die gleichen Reactionen gibt, mit Vanillin identisch ist.

2. Torf und Braunkohlen.

Untersuchung des im Torf von Aussee vorkommenden Dopplerits. Von W. Demel (Monatshefte für Chemie 1882, S. 762). Die ca. 5 Proc. betragende Asche desselben hatte folgende Zusammensetzung:

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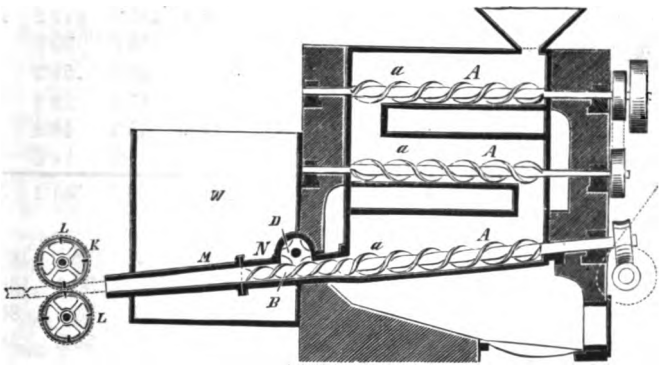
Kalk 72·67, Magnesia 2·03, Kali und Natron 0·99, Eisenoxyd und Thonerde 12·02, Schwefelsäure 4·36, Chlor 1·09, unlöslich 6·80, Summa 99·96.

Ein Torfschneider wird von G. Steeneck in Gnarrenburg (D. P. 19670) beschrieben.

Maschine zum Pressen von Braunkohlen, Lohe, Sägespänen, Torf etc. (D. P. 16768 vom 1. März 1881. E. Geisenberger und

Fig. 160.



E. Picard in Brüssel, Fig. 160.) Die Briquettemasse wird mittelst der Schrauben *a* durch die Kammern *A* eines Ofens geführt und mittelst der mit der untersten Schraube *a* verbundenen Schraube *B* und eines Sternrades *D* zum Mundstück *M* hinaus gepresst. Durch in Kasten *W* einzufüllendes Wasser können das Mundstück *M* und der Cylinder *N* gekühlt werden. Zur Teilung des Briquettstranges dienen Messer *L*, welche radial zwischen je zwei Scheiben *K* angeordnet sind. Die Achsen der Scheiben *K* sind im Gestell fest gelagert und durch zwei gleiche Zahnräder mit einander vereinigt. Der Strang setzt die Vorrichtung in Drehung. Sollen hohle Briquetts hergestellt werden, so wird die Achse der Schraube *a* bis zur Mündung des Mundstücks *M* verlängert, so dass sie einen sich drehenden Kern bildet.

Die gesamte Braunkohlenförderung des preussischen Staates betrug (nach den Mitteilungen des preussischen Handelsarchivs) im Jahre 1881: 10 412 153 t zum Werte von 31 268 991 ℳ. Dieselbe ist gegen das Vorjahr der Menge nach um 5·44 Proc., dem Werte nach um 3·66 Proc. gestiegen.

3. Steinkohlen.

Die gesamte Steinkohlenförderung betrug in Preussen in demselben Jahre (nach derselben Quelle): 43 780 545 t zum Werte von 216 973 961 ℳ, was gegenüber dem Vorjahre 3·81 Proc. der Menge nach und 3·01 Proc. dem Werte nach mehr macht. Der Durchschnittswert ging von 4·99 ℳ auf 4·96 ℳ herab.

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Die Steinkohlenförderung betrug im Oberbergamtsbezirk Dortmund 23 644 755 t, Breslau 13 110 848 t, Bonn 6 608 623 t, Clausthal 386 662 t und Halle 29 657 t.

Kohlenproduction und Kohlenconsum. Nach P. Trasenter (Revue univ. 1882, S. 324, Wagner's Jahresber. 1882, 1069). Die Kohlenproduction betrug Millionen Tonnen:

	1860	1870	1873	1878	1879	1880	1881
Grossbritannien . . .	85.4	112·2	129	134·8	135·8	149 3	156·6
Vereinigte Staaten . .	15·2	30·7	51·3	52·9	63·8	70·3	80(?)
Deutschland	12·3	34	46·1	50·5	53·5	59·2	61·5
Frankreich	8·3	13·1	17·5	16·9	17·1	19·4	19·9
Belgien	9·6	13·7	15·8	14·9	15·4	16·9	16·9
Oesterreich-Ungarn . .	3·5	8·3	11·9	13·9	14·9	16·6	16(?)
	134·3	212·0	271·6	283·9	300·5	331·1	351

Der Kohlenconsum in denselben Ländern betrug:

	1870	1873	1878	1879	1880	1881
Britannische Inseln . . .	100·5	116·5	119	119	130·1	136·7
Vereinigte Staaten . . .	30·9	51·1	52·7	63·7	70·1	80(?)
Deutschland	32·4	45·5	49·3	52·2	56·8	58·7
Frankreich	18·8	24·7	24·5	25·3	28·5	28·8
Belgien	10	11·2	10·9	11·1	12·1	12·2
Oesterreich-Ungarn . . .	8·3	12	12·6	13·9	14'6	14.6 (?)
Total . . .	201	261	269	285·2	312·2	331
Ueberschuss der Production	11	10·6	14·9	15·3	18·9	20

Die Rolle des Kohlenstaubes bei den Grubenexplosionen ist in letzter Zeit öfter discutirt worden. Aus den Versuchen Fred. Abel's (Chem. News 44, S. 1128) geht hervor, dass der Kohlenstaub die durch schlagende Wetter hervorgerufenen Explosionen auf weite Entfernungen überträgt. Man hat deshalb auch empfohlen, durch periodisches Besprengen mit Wasser die Bildung des Kohlenstaubes in den Gruben möglichst zu verhüten.

Analysen des ausziehenden Ventilator-Wetterstromes der Kohlengruben. Auf der Grube Heinitz bei Saarbrücken wurden solche Analysen mit einem modificirten Coquillon'schen Grisoumeter ausgeführt (Zeitschr. f. Berg-, Hütten- u. Salinenw. 1882, S. 53 u. 251; auch Wagn. Jahresber. 1882, 1063). Man erhielt folgende Zahlen:

am 19.	September	1881	0·568	Proc.	Kohlensäure und	0·184	Proc. Kohlenoxyd
„ 20.	„	„	0·567	„	„	0·184	„ „
„ 24.	„	„	0·488	„	„	0·187	„ „
„ 26.	„	„	0·472	„	„	0·157	„ „
„ 27.	„	„	0·544	„	„	0·122	„ „
„ 30.	„	„	0·422	„	„	0·173	„ „
„ 11.	October	„	0·438	„	„	0·130	„ „
„ 12.	„	„	0·488	„	„	0·179	„ „

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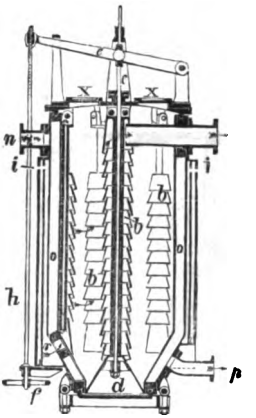
4. Briquettes.

Apparat zum Trocknen von Kohlenklein und zur Erzeugung von Briquettes. (D. P. 20527 vom 21. März 1882. Vogel & Co. in Neusellerhausen-Leipzig.) Der Apparat wird durch die Oeffnungen *x* mit dem zu trocknenden Material gefüllt. Durch das Rohr *n* gelangt Abdampf in den Raum *o*, umzieht den Apparat, giebt demselben seine Wärme ab und tritt durch *p* aus. Durch die Oeffnungen *ii* tritt Luft ein, welche durch den Abdampf mit erwärmt wird und gelangt durch die Oeffnungen *r* in durchbrochene Rohre *b* am inneren Umfange des Apparates, von welchen aus sie das Brennmaterial durchzieht, um nebst den sich aus dem zu trocknenden Material entwickelnden Wasserdämpfen durch das mittlere Rohr mittelst einer Luftpumpe abgesaugt zu werden. Die Entleerung des Apparates geschieht durch Senken der mit dem Konus *d* verbundenen Stange *c*, mittelst Hebels *e*, Stange *h* und Handrades *f*.

Fig. 161.



Verfahren zur Herstellung von Briquettes. (D. P. 15789 vom 2. März 1881. G. H. Lenk und W. M. Lehmann in Lugau, Sachsen.) Zur

Fig. 162.

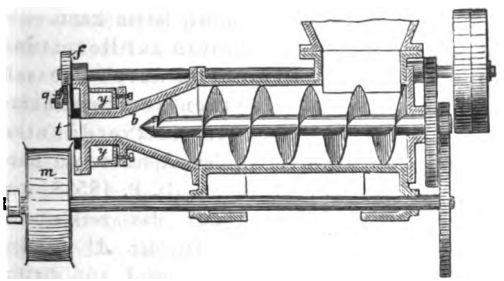
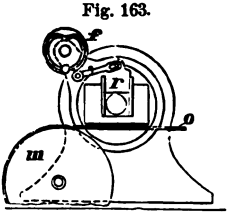


Fig. 163.



Herstellung der Briquettes werden 3 Tl. gebrannter Dolomit mit Wasser zu einem Brei gelöscht und noch heiss mit 5 Tl. Solaröl vermischt. Hiermit vermengt man ein Gemisch von 2 Tln. Braunstein und 3 Tln. Solaröl. Man erhält so eine butterartige Masse, die als Bindemittel dient und vermöge ihres Gehalts an sauerstoffabgebendem Manganoxyd die Briquetts brennbar macht; sie wird mit ihrem zehnfachen Gewicht an Kohlenklein gemischt und in die Briquettepresse gegeben. Diese gleicht einem liegenden Thonschneider. Das Mundstückende *b* ist verjüngt und wird von einem zweiteiligen Kasten *y* umgeben, der innen zwei mit zerschmolzenem essigsaurem Natron gefüllte Kapseln aufnimmt. Der Kapselinhalt bleibt, einmal

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geschmolzen, zehn und mehr Stunden lang warm und bewahrt darum die Briquettmasse in *b* vor zu schneller Abkühlung. Zum Abschneiden der Briquetts dient ein vor der Mündung der Presse durch unrunde Scheibe *f* und Winkelhebel *q* auf- und abbewegtes Messer *r* (Fig. 162 und 163). Die abgeschnittenen Briquettes fallen auf das Band ohne Ende *mo*.

Neuerung an Briquettepressen. (D. P. 21478 vom 11. Juni 1882.) R. Jacobi in Zeitz.) Während beim Inbetriebsetzen der Maschine ein Anwärmen der Form erfolgen muss, erweist sich beim Betriebe eine Kühlung der Form als notwendig, weil durch die Reibung die Briquettes in der Form nicht nur bis über die Briquettirungstemperatur, sondern noch bis über 100° erwärmt werden, wobei das in ihnen enthaltene Wasser sich in Dampf von hoher Spannung verwandelt, der beim Heraustreten des Briquettes expandirt und hierbei die glatte Oberfläche des Briquettes abwirft und das Gefüge lockert. Es werden daher Canäle *rr* in den sogenannten Formhaken *A* und *B* oder in dem Druckstück *F* oder in dem Körper *D* des Presskopfes selbst oder in allen diesen Teilen zugleich in unmittelbarer Nähe der in der Presse befindlichen Briquettessäule angeordnet, durch welche Canäle man je nach Bedarf Dampf, Kühlwasser oder andere kühlende oder erwärmende Gase oder Flüssigkeiten circuliren lassen kann.

Fig. 164.

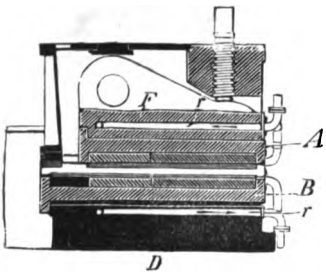
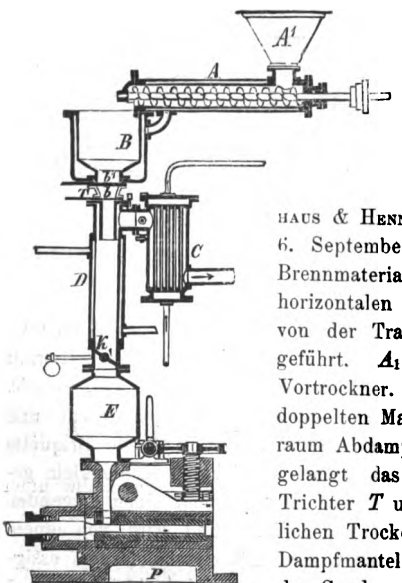


Fig. 165.



Verfahren zur Bereitung von Briquettes durch Pressen und Trocknen von Brennmaterialien im luftverdünnten Raum. In dem Apparat von Neuhaus & Henniges in Berlin (D. P. 18538 vom 6. September 1881) gelangt das zerkleinerte Brennmaterial durch den Trichter A^1 in den horizontalen Behälter *A* und wird aus diesem von der Transportschnecke in den Behälter *B* geführt. A_1 *A* und *B* bilden zusammen den Vortrockner. Die Teile *A* und *B* sind mit einem doppelten Mantel umgeben, in dessen Zwischenraum Abdampf von der Maschine tritt. Aus *B* gelangt das Material durch den beweglichen Trichter *T* und die Schieber bb^1 in den eigentlichen Trockenraum *D*, der ebenfalls von einem Dampfmantel umgeben ist. Hier wird mittelst des Condensators *C* und einer mit diesem ver-

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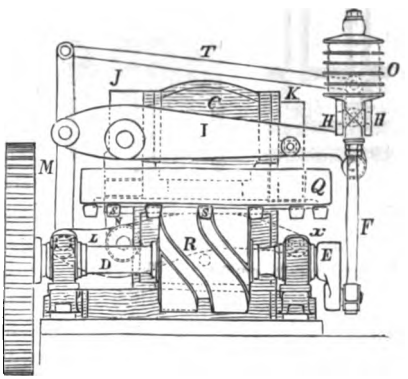
bundenen Luftpumpe eine Luftverdünnung hergestellt, um das Trocknen des Brennmaterials zu befördern, sowie um etwa eingeschlossene Luft auszutreiben. Aus *D* gelangt das Material nach dem Oeffnen der Klappe *K* in den Raum *E*, der mit der Presse *P* in directer Verbindung steht. Der Condensator ist mit einem Hygrometer und Vacuummeter, der Raum *D* mit einem Thermometer versehen.

Bei der Presse von Paul Couffinhal in St. Etienne (D. P. 15239 vom 10. Februar 1881), die mit rotirendem Formentisch *Q*, Fig. 166, versehen ist, wird der Stein durch die Stempel *J* und *N* gepresst und nach einer halben Drehung durch Stempel *K* ausgestossen, worauf die Form von neuem mit der Briquettmasse gefüllt wird. Der Stempel *J* und der Ausstossstrmpel *K*, beide geführt an dem Gestell *C*, sind zwischen zwei oberen Balanciers *I* befestigt; in ähnlicher Weise ist der Gegenpressstempel *N* zwischen den unteren Balanciers *L* angebracht. Die unteren Balanciers *L* drehen sich am Gestell bei *X* und sind mit ihren freien Enden durch ein elastisches Zwischenglied mit den Stangen *M* verbunden. Die oberen Balanciers *I* sind einerseits an den Stangen *M* drehbar und andererseits durch Zwischenstück *H* verbunden und mit diesem an zwei Pleuelstangen *F*, die in Puffern *O* endigen, elastisch befestigt. Die zwei Pleuelstangen *F* werden von zwei Rädern *G* und Wellen *D* aus durch die Kurbeln *E* anf- und niederbewegt, wobei eine Parallelführung von *F* und *M* durch die Verbindungsstange *T* erreicht ist. Die beiden Wellen *D*, welche sich mit gleicher Geschwindigkeit drehen, tragen zwei Führungscylinder *R*, welche den Tisch seitlich unterstützen und ihn zugleich drehen, falls die Rollen *S* am Tische in die schrägen Teile der in *R* eingearbeiteten Führungen eingreifen. Die Teile der Führungen, welche in einer zur Achse senkrechten Ebene liegen, bewirken die Arretirung des Formentisches beim Pressen, und da hierbei jeder Führungscylinder auf drei Rollen *S* wirkt, so ist die Arretirung besonders gesichert.

Fig. 166.



5. Coks.

Das Bestreben, mit der Herstellung von Coks die gleichzeitige Gewinnung von Ammoniak und Teer zu verbinden (vgl. Techn.-chem. Jahrb. 1883, S. 135), ist auch in diesem Berichtjahre in Form verschiedener Patente zum Ausdrucke gelangt. Die vielfachen, zum Teil bereits erfolgreichen Versuche zur Lösung dieser wichtigen Aufgabe haben auf dem Gebiete der

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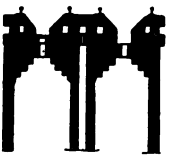
Coksfabrikation, soweit es Verbesserungen von Ofenconstructionen etc. und dgl. betrifft, eine grosse Rührigkeit verursacht.

Neuerung an Coksöfen. (D. P. 20908 vom 10. Februar 1882. C. Otto u. Co. in Dahlhausen a. d. Ruhr.) In den Seitenwänden, dem Gewölbe und event. dem Boden des Sohlcanals *a* sind kleine Canälchen *b* ausgespart, die einerseits mit der atmosphärischen Luft, und zwar regulirbar durch Stopfen, andererseits mit verschiedenen Stellen des Sohlcanals *a* communiciren, sodass man mit Hilfe derselben Verbrennungsluft nach beliebigen Stellen des Sohlcanals leiten kann.

Fig. 167.

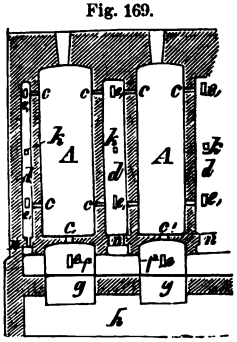
Fig. 168



H. Müller in Kohlscheid bei Aachen (D. P. 20582 vom 23. Mai 1882) ersetzt das Deckgewölbe der gewöhnlichen Coksöfen durch eine durch stufenweises Ueberkragen der Seitenwände gebildete Decke, welche in der Mitte eine nur durch einzelne Brücken unterbrochene und oben durch Deckplatten verschliessbare schmale Längsplatte erhält.

Kohlenschmelz- und Entgasungs-Ofen mit vollständiger Rauchverbrennung für Coksproduction. (D. P. 21455 vom 2. Juli 1882. A. Hiltawski in Zaborze.) Die Gase entweichen aus dem Vercokungsraum *A*, teils durch Schlitze *c* in die den ganzen Raum *A* entlang sich erstreckenden Canäle *d*, wo sie mit der durch Oeffnungen e_1 und *k* eintretenden Luft verbrennen, teils durch Schlitze c_1 in dem Boden in die Canäle *f*, wo sie mit der durch *e* eintretenden Luft verbrennen. Die Verbrennungsproducte aus den Canälen *d* vereinigen sich durch die Oeffnungen *n* hindurch mit denen der Canäle *f*, und gelangen aus letzteren Canälen durch die Oeffnungen *g* in den zur Esse führenden Sammelcanal *h*. Die Schlitze *c* und c_1 werden durch die Oeffnungen e_1 und *e* mittelst sogenannter Spalteneisen gereinigt. Die Oeffnungen *n* werden durch Schieber regulirt.

Fig. 169.



Verfahren zur Herstellung von gepresstem Coks und Coksbriquets in Coksöfen mit intermittirendem Betriebe. (D. P. 18693 vom 22. November 1881. Fritz Lürmann in Osnabrück.) Das Verfahren bezweckt die Vercokung schwer vercokbaren Materials und besteht in der Ausübung äusseren mechanischen Drucks auf das in dem Entgasungsraum befindliche Material in der Zeit zwischen Füllung und Entleerung desselben. Eine gewisse Menge Material wird in den Entgasungsraum gebracht und durch die Coksausdrückmaschine oder auf andere Weise zusammengepresst; hierauf wird eine neue Menge eingebracht, diese wieder zusammengepresst

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u. s. f., bis der ganze Entgasungsraum gefüllt ist. Hierauf wird die Thür geschlossen.

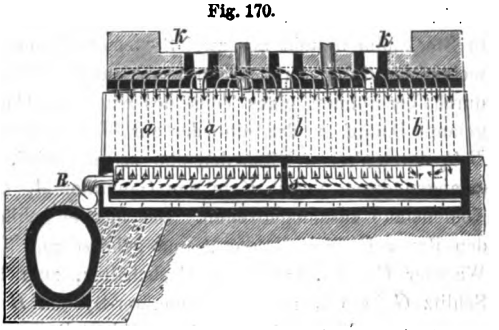
F. Lürmann hat Neuerungen an Entgasungsräumen mit continuirlichem Betriebe angebracht und dieselben für Destillations- oder Sublimationsapparate, Coksöfen mit oder ohne Gewinnung von Teer, Ammoniak etc., Generatoren und Entgasungsräume mit intermittirendem Betriebe angeordnet. (D. P. 18927 vom 12. Januar 1882.) Die Uebertragung der früher beschriebenen*) Einrichtungen auf bereits vorhandene Coksöfen wird dadurch erreicht, dass die Druckfläche des Beschickapparates den jeweiligen Querschnitten des Entgasungsraumes und der Art des zu entgasenden Materials angepasst wird. Diese Anpassung der Druckfläche des Beschickapparates kann auf dreierlei Art geschehen, indem man die Druckfläche entweder niedriger, oder schmaler, oder niedriger und schmaler macht, als den Anfangsquerschnitt des vorhandenen Entgasungsraums.

Während nach dem Hauptpatent die Austrittsöffnungen für die Destillationsproducte nur in den Gewölben der Entgasungsräume angeordnet waren, sind nach dem D. P. 20211 diese Oeffnungen in den Seitenwänden und zwar nahe an dem Entleerungsende angebracht. Die Entgasungsräume werden stets nur teilweise entleert, indem man entweder ein dem garen Stück Coks entsprechendes Quantum frischer Kohlen an der Beschickungsseite mittelst der vorhandenen Beschickapparate ein- und so die garen Coks am Entleerungsende ausdrückt, oder indem man nur die garen Coks am Entleerungsende durch eine maschinelle Vorrichtung auszieht.

Ferner hat Lürmann die in dem Patent 15512 und dem Zusatz-Patent 16741**) dargestellten Einrichtungen auf Coksöfen mit intermittirendem Betrieb übertragen.

C. Otto & Co. in Dahlhausen a. d. Ruhr haben eine Ofenconstruction angegeben, durch welche Coppe'sche Coks-Oefen mit der Einrichtung zur Teer- und Ammoniakgewinnung versehen werden. Zu diesem Zwecke sind die Sohlcanäle durch eine oder mehrere Scheidewände *s* der Länge nach in mehrere Abteilungen zerlegt. Jede Abteilung steht mit einer Anzahl von Verticalzügen in den Seitenwänden in Verbindung und diese wieder unter einander. Die von Teer etc. befreiten Coksofengase treten durch den Injector *R* in die erste Abteilung des Sohlcanals, gehen durch die Verticalzüge *a*

Fig. 170.



*) Techn.-chem. Jahrb. 1882, S. 50; 1883, S. 147.

**) Techn.-chem. Jahrb. 1883, S. 146.

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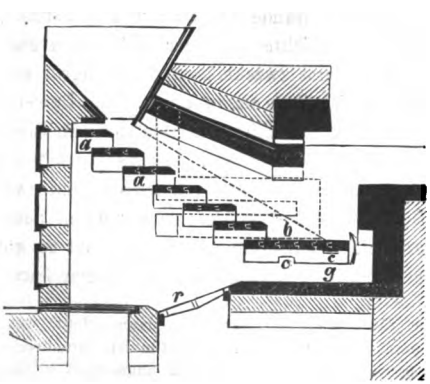
weisse Wölkchen dem Kamine, welche natürlich bei dem jedesmaligen Nachlegen momentan etwas schwärzer gefärbten Rauchwolken weichen müssen.

Die Wirkung dieses einfachen Hülfsmittels erklärt sich dadurch, dass die aus dem „Neste" entweichenden, halbverbrannten und mit Kohlenruss beladenen Gase durch den ringsherum befindlichen glühenden Wall zur völligen Verbrennung gelangen. Es ist jedoch zu beachten, dass dieses Hülfsmittel für die Grossindustrie sich weniger eignet und dass es etwas mehr Kohlen erfordert. Auch eignet sich nicht jede Kohle gleich gut hierzu, die Saarkohle beispielsweise weniger als die belgische.

Vergleichende Versuche einer Ten Brink-Feuerung und einer Planrost-Feuerung wurden auf der Heizversuchsstation München angestellt. H. Bunte berichtet über das Ergebnis der Versuche Folgendes: Der Nutzeffect der Planrost-Feuerung verhält sich zur Ten-Brink-Feuerung wie 100 : 114·6. Der grössere Nutzeffect der letzteren ist fast ausschliesslich auf die Verbrennung mit geringerer Luftmenge zurückzuführen. Während bei der Ten-Brink-Feuerung bei durchschnittlich 9·6 Proc. Kohlensäure in den Rauchgasen auf diesem Wege nur zusammen 28·8 Proc. des Heizwertes verloren gingen, beträgt dieser Verlust bei der Planrost-Feuerung (mit 6 Proc. Kohlensäure) 30·6 Proc. oder 8·8 Proc. mehr. (Bayr. Ind.- u. Gew.-Blätter 14, 175; auch in Chem.-Ztg.)

Ueber Versuche mit Braunkohlen an Kesseln der neuen Baumwollen-Spinnerei Hof wird an derselben Stelle berichtet. Die Verdampfung entsprach bei vier Kesseln 42·8 Proc., 47·7 Proc., 49·2 Proc., 52·7 Proc. des Heizwertes der Kohlen. Trotz Zuführung der $2^1/_2$- bis 3fachen der theoretisch zur Verbrennung erforderlichen Luft entweichen dicke Russwolken aus dem Schornsteine. Es war dies durch den Charakter der zum Versuche verwendeten Chodauer Braunkohle, welche bei der Vercokungsprobe über 60 Proc. flüchtige Bestandteile lieferte, bedingt. Die plötzliche Entwickelung dieser Gase und des hygroskopischen Wassers verursacht bei intermittirender Beschickung eine starke Abkühlung des Feuerraumes, wodurch die vollständige Verbrennung auch bei grossem Luftüberschuss verhindert wird. Bei Anwendung schief liegender — Ten-Brink- oder Treppenroste — würde dieser Uebelstand weit besser vermieden werden.

Fig. 174.



Treppenrostfeuerung. (D. P. 20859 vom 15. Juli 1882. H. Randhahn in Waldau bei Osterfeld, Kreis Weissenfels.) Die Feuerungsanlage, Fig. 174,

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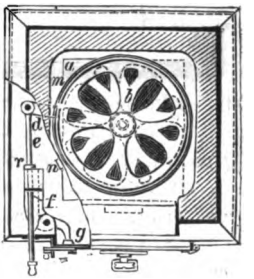
besteht aus einer grösseren Anzahl vom Chamottebögen *a*, deren letzter *b* doppelt so breit ist als die übrigen und mit Schlitzen *c* versehen ist. Durch letztere fällt das entgaste Brennmaterial auf die Fläche *g* und wird von hier auf den Rost *r* gezogen, wo es gänzlich verbrennt.

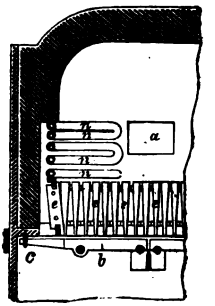
Ein Regulirrost (D. P. 17893 vom 22. Mai 1881) von Wurmbach in Bockenheim bei Frankfurt a. M. besteht aus dem festen Unterteil *a* und der auf diesem drehbaren Scheibe *b*. Beide Teile haben gleiche Aussparungen. Durch deren gegenseitige Stellung werden die Spalten und Stege des Rostes gebildet. Die obere Scheibe *b* wird mittelst des Hebels *d* bewegt, welcher auf einem in der Scheibe *b* eingegossenen, durch den Unterteil *a* hindurchgehenden Zapfen befestigt ist. Mit dem äusseren Ende des Hebels *d* ist die Zugstange *e* verbunden, welche, durch den Sockel des Ofens gehend, einen Knopf als Handgriff hat. Das Aufrütteln des Rostes während des Brennens erfolgt durch abwechselndes Vor- und Rückwärtsbewegen der Stange *e*, wodurch der entsprechende Spaltenwechsel entsteht. Bei normaler Stellung des Rostes legt sich der Hebel *d* gegen den Knaggen *m*, wodurch die Rückwärtsbewegung begrenzt ist. Um die Bewegung des Rostes nach der vorderen Seite hin zu begrenzen, wird die Stange *e* durch das hintere gabelförmige Ende des Doppelhebels *f* geführt, so dass der Bund *r* bei der äussersten Stellung der Stange *e* gegen dieses Ende des Doppelhebels *f* stösst. Der Doppelhebel *f* wird durch die Aschenfalltür, welche in ihrer geschlossenen Lage bei *g* gegen den zweiten Arm des Hebels *f* drückt, in seiner, den Weg der Zugstange *e* begrenzenden Stellung gehalten.

Fig. 175.



Neuerungen an Feuerungsanlagen. (D. P. 20719 vom 8. Februar 1882. A. C. Felton in Warwick, Massachusetts.) *a* ist die Schüröffnung, *b* sind die Bodenroststäbe, welche durch Haken *c* gehalten werden und um die Zapfenstangen *d* gedreht werden können; *e* sind die Seitenroststäbe, durch welche die Luft von der Seite her zum Feuerraum gelangen kann. Zur Regulirung des Luftzutrittes können geeignete Klappen angebracht werden; ferner sind die Stäbe nach oben hin dicker gemacht, so dass in den Raum über dem Brennmaterial weniger Luft treten kann als zum Brennmaterial. Anstatt des feuerfesten Ofenfutters ist über dem Verticalroste ein Wasserrücken angebracht. Derselbe besteht entweder aus einem eisernem Troge, oder, wie in der Fig. 176 dargestellt, aus einer Anzahl horizontaler Röhren *n*, welche mittelst durchfliessenden Wassers und durch die zwischen ihnen circulirende Luft abgekühlt werden.

Fig. 176.



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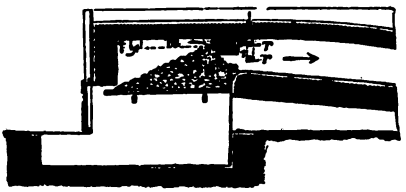
Bei den Flammöfen- und Kesselfeuerungen von W. Wilmsmann in Hagen (D. P. 19749 vom 25. December 1881) ist über der Feuerbrücke ein Bogen (Wehr) angebracht, der durch Wasser oder Luft gekühlt wird. Gegen denselben wird das Brennmaterial geschüttet. Die sich im Feuerungsraum über dem Brennmaterial bildenden Gase werden durch den Canal *t m p* in die glühenden Kohlen abgeleitet. Durch die Oeffnungen *r* wird secundäre Verbrennungsluft zugeführt.

Fig. 177.



Zur Erhöhung des Heizeffects bei Dampfkesselfeueranlagen. (Gew.-Bl. f. Hessen 1883, 176.)

Ueber Gasfeuerungen. Von Director Siegel. (Wochenschr. d. Ver. deutsch. Ing. 1883, 136.)

Die Gasfeuerung bei der k. k. Saline Aussee mit Torf und Traunthaler Lignit. Von Johann Heupel. (Oest. Zeitschr. f. Berg- u. Hüttenw. **30**, 410.)

Neuerungen an den im D. P. 16223*) beschriebenen Generatoren von C. W. Siemens beziehen sich auf die Einführung von vorgewärmter oder nicht vorgewärmter Verbrennungsluft, welche unter Druck durch die Düsen *C* (Fig. 178) gegen die Mitte des in dem Generator befindlichen Brennmaterials eingeführt wird. Die Luft wird in spiralförmig gewundenen Röhren C^1, welche von den abziehenden Gasen umspült werden, erhitzt.

Fig. 178.

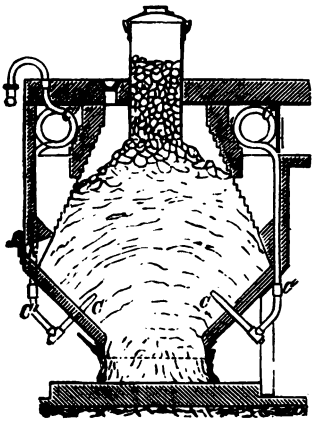
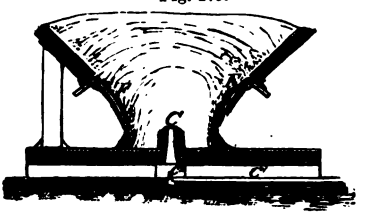


Fig. 179.



Die zweite Neuerung betrifft die Anordnung von geneigten Roststäben *F* (Fig. 179), an denen beständig Wasser niederfliesst behufs Erzeugung von Wasserdampf, welcher in den Generator eindringen soll. Die Verbrennungsluft tritt durch einen centralen Canal *C* ein. Dampf wird durch das Rohr C^1 C^2 zugeführt. (D. P. 20726 vom 28. März 1882.)

Damit bei Siemens'schen Regenerativöfen Gas und Luft, durch leicht

*) Techn.-chem. Jahrb. 1883, S. 148.

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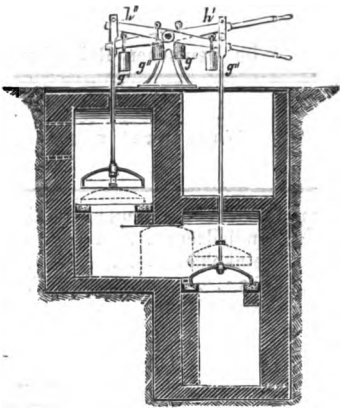
entstehende undichte Stellen im Mauerwerk tretend, sich nicht vorzeitig mischen, werden nach D. P. 19070 vom 1. December 1881 von H. Weissenfels in Styrum zwischen den einzelnen Zügen, sowie zwischen den Gas- und Luft-Kammern senkrechte und horizontale, sich kreuzende Oeffnungen im Mauerwerk angebracht. Hindurchtretende Gase und Luft können nur in die Atmosphäre entweichen.

A. Pütsch in Berlin hat Neuerungen an Generatoren mit umgekehrter Zugrichtung (D. P. 19844 vom 15. Juli 1881) angebracht, um die ausströmenden heissen Gase unter gleichzeitiger Ausnutzung ihrer freien Wärme abzukühlen und sie dadurch für eine weitere Leitung nach dem Verbrennungsorte geeignet zu machen. Der Generator wird zu diesem Zweck mit einem Regenerator, Recuperator oder Röhrenapparate, durch den die heissen Gase ziehen, combinirt, oder aber die Gasabzüge des Generators werden derartig angeordnet, dass die gebildeten Gase vor ihrem Eintritt in die Gasleitung den Generatorschacht umspülen, um das in demselben für die Vergasung enthaltene frische Brennmaterial vorzuwärmen, bezw. zu entgasen.

Neuerungen an Ventilverschlüssen zum Umstellen der Flammenrichtung bei Regenerativ-Gasfeuerung. (D. P. 21651 vom 7. Juli 1882. Paul Berndt und Baldermann in Finkenheerd.)

Fig. 180.



Die Ventilglocken sind zu je zwei an Hebel $h' h''$ gehängt, welche, ausserhalb der Kammern angeordnet, sich um eine gemeinschaftliche Achse drehen. Beide Hebel sind mit den Laufgewichten $g' g'$ und $g'' g''$ versehen, von denen das eine beim Umlegen des Hebels nach der Hebelachse und das andere nach dem Hebelende zueilt, so dass der Schwerpunkt des Laufgewichtpaares im Sinne der Bewegung und zugleich nach der Seite hin vorrückt, auf welcher sich das auf seinen Sitz zu pressende Ventil befindet.

Zur Beurteilung von Feuerungsanlagen. Von F. Fischer (Dingl. pol. Journ. 245, S. 357; Wagner's Jahresber. 1882, 1131). Enthält der verwendete Brennstoff nach der Analyse einer guten Durchschnittsprobe c Proc. Kohlenstoff, h Proc. Wasserstoff, s Proc. Schwefel, o Proc. Sauerstoff und w Proc. Wasser, so erfordert 1 kg Kohle:

$\frac{2{\cdot}667\,c + 8\,h + s - o}{100}$ kg oder $\frac{2{\cdot}667\,c + 8\,h + s - o}{100 \times 1{\cdot}43}$ cbm Sauerstoff, oder

$\frac{2{\cdot}667\,c + 8\,h + s - o}{21 \times 1{\cdot}43}$ cbm atmosphärische Luft zur vollständigen Verbrennung (wenn dieselbe 21 Proc. Sauerstoff enthielt).

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Die Temperatur der abziehenden Rauchgase bestimmt F. Fischer mittelst 75 cm bis 1 m langer Thermometer, welche von W. Apel in Göttingen zum Preise von 5·50 ℳ resp. 12 ℳ zu beziehen sind. Letztere (1 m langen) Thermometer haben Stickstofffüllung. (Die gewöhnlichen Thermometer ohne Stickstoff sind nur bis 300° völlig zuverlässig.) Die Thermometer werden in den Rauchcanal vor dem Schieber so eingesetzt, dass die Quecksilberkugel sich möglichst mitten im Gasstrom befindet.

Die Ablesungen erfolgen so oft (oder halb so oft), als Gasproben genommen werden. Haben die Rauchgase eine Temperatur von über 360°, so ist für genaue Versuche die Bedienung der Feuerung entsprechend zu ändern. Ein bei den Rauchgasanalysen etwa gefundener nennenswerter Gehalt von Kohlenoxyd zeugt von mangelhafter Dampfkesselfeuerung.

Ergab die Analyse k Proc. Kohlensäure, o Proc. Sauerstoff und n Proc. Stickstoff, so ist das Verhältnis der gebrauchten Luftmenge zu der theoretisch erforderlichen, wenn die Verbrennungsluft x Proc. Sauerstoff und z Proc. Stickstoff enthält:

$$v = \frac{x}{x - (z\,o : n)} \text{ oder } \frac{n}{n - (z\,o : x)} \text{ bezieh. } \frac{21}{21 - (79\,o : n)}.$$

Fr. Boeckmann.

Statistik.

Im Deutschen Reich betrug, in metrischen Centnern ausgedrückt, die

Waarengattung	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an Petroleum, roh und gereinigt	3 421 741	3 514 982	7 942	5 494
„ Zündhölzern	4 801	5 583	25 300	23 799
„ Steinkohlen	20 906 217	21 312 889	76 315 350	82 875 678
„ Coks	2 013 234	1 867 601	4 786 308	5 480 488
„ Braunkohlen	30 209 831	31 826 132	351 355	429 189

XXI. Zucker.

I. Rübenbau und Rübenernte.

Zur Wertprüfung von Runkelrübensamen wurde von F. Nobbe (Landwirtschaftl. Versuchsstationen 27, 283; Wagn. Jahresber. 1882, 711) folgendes Verfahren angegeben*): Man zählt von der Mittelprobe zwei- oder dreimal 100 Fruchtknäule in dem Sinne ab, dass jedes Hundert möglichst annähernd dem Durchschnittscharakter der Probe entspricht und setzt sie nach einer 6—12stündigen Vorquellung zum Keimen an. Die jeweils

*) Vgl. über Prüfung der Keimfähigkeit von Rübensamen Techn.-chem. Jahrb. 1883, S. 159.

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gekeimten Knäule werden, nach Maassgabe der von ihnen gelieferten Anzahl von Keimpflänzchen, zur weiteren Beobachtung in ein besonderes Keimbett übertragen und diese Operation bei jeder Revision wiederholt, so dass beim Abschluss des Versuchs, nach 14 Tagen, für jedes hundert Knäule 3—8 (meist 4—6) Keimstätten vorliegen. Aus der Knäulzahl jedes Keimbetts, multiplicirt mit der demselben zugehörigen Keimziffer, ergibt sich durch Addition die rohe Keimkraft der Probe und zugleich das Verhältnis, in welchem die einzelnen Knäule am Gesamtergebnis beteiligt sind. Alsdann werden die rückständigen Samen herausgebohrt und damit die wahre Keimkraft der Probe, bezogen auf die zur Keimung angesetzten Samen, gewonnen. Durch die Wägung von (in der Regel dreimal) 1 000 Fruchtknäulen ermittelt man sodann, wie viele Knäule und keimfähige Samen in 1 kg der Waare enthalten sind. Die Bestimmung der fremden Bestandteile und event. des Wassergehalts der Probe normirt schliesslich deren Nettogebrauchswert und die erforderliche Aussaatmenge.

Versuche zur Bekämpfung der Rübennematoden wurden von J. Kühn (Zeitschr. des deutschen Ver. f. Rübenz. **31**, 102) angestellt. Die Versuche erstreckten sich zunächst auf die Anwendung giftig oder ätzend wirkender Substanzen. Hierbei bewährte sich zunächst der Aetzkalk zur Abtödtung der Nematoden auf dem Acker nicht, dagegen leistete derselbe gute Dienste, um die in dem Rübenabfall enthaltenen Nematoden zu tödten (auf höchstens 6 Raumteile lufttrockenen oder nur mässig feuchten Rübenabputzes 1 Raumteil Kalk). Weitere, ebenfalls fruchtlose Versuche wurden mit einem „Phenolkalk" gemacht welcher durch Versetzen der bei dem Reinigen des Paraffins als Abfall gewonnenen Brandharze mit Aetzkalk gewonnen wurde. Bessere Resultate lieferte der „präparirte Guano" von Herrn E. R. G. Bürstenbinder in Hamburg. Dieses vom Erfinder neuerdings „Regenerator" genannte Mittel wird am zweckmässigsten im Herbst angewendet.

Kühn berichtet sodann über seinen schon früher gemachten Vorschlag, die Vertilgung der Nematoden durch Ansaat und rechtzeitige Aufnahme von „Fangpflanzen" zu versuchen. Es wurden Versuche mit Rübsen, Raps, Kohlrübe, Blattkohl, Rosenkohl, Wirsing, Kopfkraut, Kohlrabi, Blumenkohl, weissem Senf, Gartenkresse, Rettig und Spinat gemacht. Es sind dies sämtlich Lieblingsnahrungspflanzen der Nematoden, welche sie nächst der Runkelrübe am meisten bevorzugen. In Bezug auf feine Bewurzelung standen die Abänderungen von Blattkohl (*Brassica oleracea acephala L.*) allen anderen Fangpflanzen vor. Nächstdem zeigte sich die Kresse am günstigten. Die ungünstige Wahrnehmung, dass die Kohlpflanzen und die Kresse von den Erdflöhen während eines Versuchsjahres grösstenteils vernichtet wurden, führte den Verfasser später dazu, ausschliesslich den Sommerrübsen als Fangpflanzen anzuwenden. Dieser wird zwar auch von den Erdflöhen heimgesucht, leidet aber doch weniger als die Kohlsorten und Kresse.

Durch die während der Vegetationszeit eines Jahres (von Frühjahr bis

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Ende August) dreimal wiederholte Ansaat der Fangpflanzen wurde die vermeintliche „Rübenmüdigkeit" eines Versuchsbodens vollständig beseitigt und derselbe zu der gleichen Ertragshöhe gebracht, welche der rübensichere Acker in demselben Jahre, bei gleicher Anbauweise und gleicher Düngung zeigte. Immerhin erfordert auch diese Methode der Nematodenbekämpfung eine nicht unerhebliche Arbeitskraft. Zwar sind gegenüber dem erzielten Erfolge die Kosten nicht zu hoch, aber es ist nicht leicht, zur Bewältigung grösserer Flächen ausreichende Arbeitskräfte für eine relativ kurze, bestimmt abgemessene Frist zu beschaffen. Kühn empfiehlt deshalb auch, mittelst dieser Methode nur allmälig mit der Bekämpfung der Nematoden voranzuschreiten und die am intensivsten heimgesuchten Felder zuerst in Angriff zu nehmen.

Ueber die Anwendung des Ammoniumsulfates und Chilisalpeters zur Rübencultur hat P. Dehérain Versuche auf dem Felde zu Grignon (Frankreich) angestellt, welche ergaben, dass der Chilisalpeter den Zuckergehalt der Rübe vermindert und das Ammoniumsulfat den Ertrag herabdrückt. Die „Chem.-Ztg." macht darauf aufmerksam, dass diese Resultate direct denjenigen widersprechen, welche die ausgedehnten Versuche von Prof. Maercker in der Provinz Sachsen geliefert haben. Geboten ist für die gute Wirkung nur die zeitige Düngung mit diesen Salzen, worüber Dehérain indessen keine Angaben gemacht hat. (Zeitschr. f. Rübenz.-Ind. **11**, 14; Journ. des Fabr. de sucre 1883.)

Die Düngung der Rüben mit im Robertkörper eingedicktem Osmosewasser ist nach H. Briem nicht zu empfehlen. Die Untersuchung zahlreicher mit und ohne Osmosewasserdüngung erzielten Rüben ergab im Mittel:

	ohne	mit	
Mittleres Gewicht der Rüben	496·00	865·00	g
Saft: Sacharimeter	14·9	13·6	„
Polarisation	12·16	10·28	„
Differenz	2·74	3·32	„
Quotient	81·6	75·6	„
Stammer'sche Wertzahl	9·8	7·8	„
Auf 100 Zucker kommen Nichtzucker . .	22·5	32·3	„

(Organ des österr. Vereins für Rübenzucker **20**, 27; Zeitschr. d. deutschen Vereins f. Rübenzucker **31**, 199.)

Die Erntemenge pro Hektar in Frankreich. Dieselbe beträgt nach dem „Cultivateur de betteraves" in den für den Rübenbau wichtigeren französischen Departements:

Im Departement	Nord . . .	46 282	kg	pro	Hektar,
„ „	Pas-de-Calais .	40 000	„	„	„
„ „	Somme . . .	31 500	„	„	„
„ „	Oise	31 600	„	„	„
„ „	Aisne . . .	31 619	„	„	„
„ „	Seine-et-Marne	35 591	„	„	„
	Im Mittel	35 852	kg	pro	Hektar.

(Stammer's Jahresbericht 1882, 416.)

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2. Aufbewahrung der Rüben.

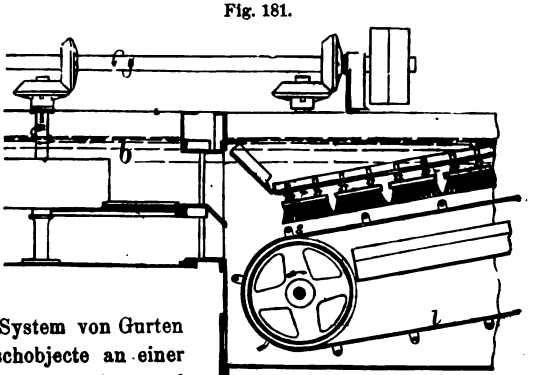
Ueber die Gewichts- und Qualitätsveränderungen im eingemieteten Zustande berichtet G. Marek. (Zeitschr. d. deutschen Vereins f. Rübenzucker **33**, 16.) Die Saftpolarisation und der Reinheitsquotient fallen etwa von Mitte Januar an rasch, während der Nichtzuckergehalt, welcher um dieselbe Zeit sein Minimum erreicht hatte, von da ab steigt. Die Marek'schen Versuche bestätigen den Erfahrungssatz, dass die Verarbeitung der Rüben im vierten Quartal des Jahres am zweckmässigsten ist. Marek teilt folgende Tabelle mit:

Datum der Untersuchung	Specifisches Gewicht des Saftes	Trockensubstanz des Saftes	Polarisation des Saftes	Nichtzuckergehalt	Reinheitsquotient	Trockensubstanz der ganzen Rübe
23. November	1·072	17·454	15·76	1·694	90·29	20·69
14. December	1·0745	17·939	16·22	1·719	90·46	20·45
17. Januar	1·072	17·454	15·87	1·584	90·92	19·48
28. „	1·069	16·767	14·92	1·847	89·01	18·38
16. Februar	1·064	15·604	13·51	2·094	86·60	18·03
7. März	1·058	14·190	11·94	2·250	84·13	17·605
28. „	1·0575	14·071	11·78	2·291	83·72	16·923

3. Reinigung und Transport der Rüben.

F. W. Hering in Osterfeld, Weissenfels hat seine Waschmaschine (D. P. 20344 vom 3. Januar 1882) verbessert. Im Anschluss an das Waschbassin *b* der Hering'schen Rübenwäsche wird ein auf zwei oder mehreren Trommeln liegender Gurt *l* oder ein System von Gurten verwendet, um die Waschobjecte an einer Bürstenreihe entlang zu transportiren und dieselben dann auszuwerfen.

Fig. 181.



Bei der Vorrichtung zum Abscheiden der Steine bei Rübenwaschmaschinen (D. P. 20505 vom 9. Mai 1882) von J. Zweigart*) in Adlerkosteletz kommen die Rüben direct in die Trommel der Waschmaschine *W*, nicht, wie früher, erst in einen vorderen Steinsammler. Die Waschtrommel ist mit bogenförmigen Einschnitten versehen, die nach aussen ge-

*) Techn.-chem. Jahrb. 1882, S. 228.

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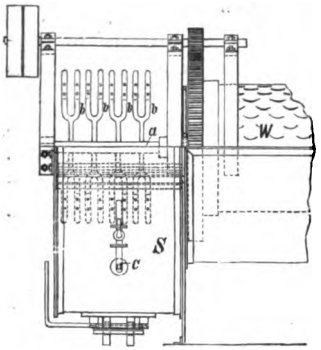
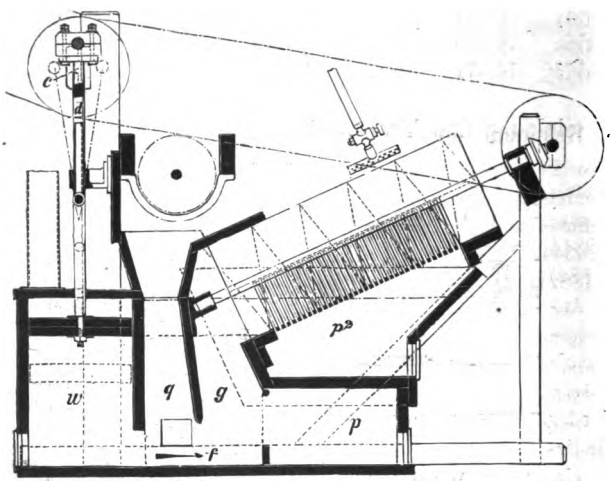
Fig. 182.



bogen sind. Hierdurch wird der Ein- und Austritt des Wassers gefördert. Nach dem Verlassen der Trommel werden die Rüben in dem Steinsammler *S* mittelst des aus Rohr *C* kommenden Wasserstrals von den Steinen befreit und durch die auf der Waschtrommelwelle *a* sitzenden gabelförmigen Arme *b* auf ein Lattentuch gehoben, das sie nach aussen führt.

Die Waschmaschine für Kartoffeln, Rüben u. dergl. (D. P. 21889 vom 22. April 1882) von J. Heyn in Stettin hat eine schräg gegen den Horizont gerichtete Schnecke; die Böden der Kästen des Förderwerks (Schnecke oder Schaufelrad) sollen siebartig hergestellt werden; das Förderwerk soll mit dem unteren Ende in einem Trog stehen,

Fig. 183.



der mit Wasser und den genannten Früchten angefüllt ist, mit dem anderen Ende aber aus diesem Trog herausragen und so die Früchte, aber nicht das Wasser aus dem Trog herausschaffen. So lagert sich im Kolbenraum *w* der schwere, reine Sand ab; im unteren Teil der Räume *q* und *g* lagern sich Steine etc. ab; im Schmutzkasten *p* sammelt sich der leichte Sand, Schlamm und die Keime; im Schmutzkasten p^2 sammeln sich ebenfalls Keime etc.

Vorrichtung zum automatischen Entfernen von Schmutzansammlungen in Wäschen. Von Leinhaas & Hülsenberg. (Zeitschr. d. deutschen Vereins f. Rübenzucker **31**, 209.)

4. Saftgewinnung.

Gebr. Köllmann in Barmen stellen an ihren Schnitzelmaschinen (D. P. 20694) die Schneidrippen *v* der Messer nicht geradlinig, sondern ge-

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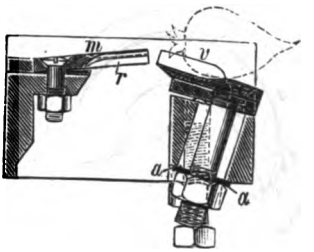
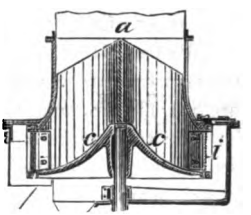
wölbt her. Es ist noch ein Nachschneidmesser *m* mit dachförmiger Schneidkante und Zerteilungsrippen *r* in dem Messerkasten angeordnet. Um die schräg in die Höhe gestellten Vorschneidmesser sicher zu befestigen, ist die Auflagefläche für die betreffenden Muttern unter einem Winkel zur Unterfläche des Messerkastens geneigt. Die Unterlagsscheiben *a* für die Muttern überdecken das Stellloch vollständig. In dem Zuführungstrichter sind unter einem Winkel zur verticalen Richtung Flügel angeordnet, um den erforderlichen künstlichen Druck auf die Rüben automatisch durch die Drehung der Messerscheibe hervorzubringen.

Fig. 184.



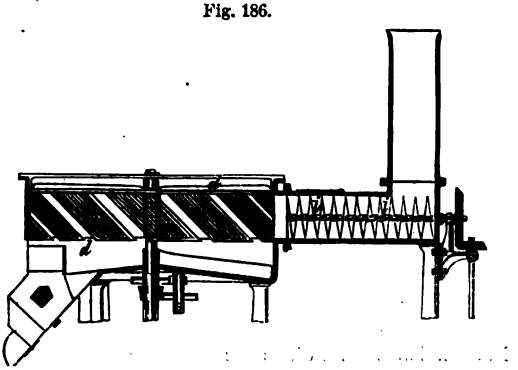
In der Rübenschnitzelmaschine (D. P. 21748 vom 11. August 1882) von Fr. Rassmus in Magdeburg werden die in den Rumpf *a* fallenden Rüben durch den mit radialen Rippen besetzten rotirenden Konus *c* centrifugal gegen die feststehenden in der Peripherie eines Cylinders angeordneten Messer *i* geschleudert. Bei einer zweiten Construction werden die Rüben durch eine Schnecke oder durch ihre eigene Schwere gegen den mit Messerkasten besetzten rotirenden Schnitzelcylinder gedrückt, während der Konus *c* feststeht.

Fig. 185.



C. Kesseler in Berlin (D. P. 20688) ordnet die Messerkästen *m* auf der Peripherie eines um seine verticale Achse rotirenden Cylinders *d* an. Fig. 186. Die Rüben werden durch eine Transportschnecke *i* oder einen Poussoirkolben gegen die Peripherie geschoben. Es wird dadurch auf der ganzen Schnittfläche eine gleichmässige Geschwindigkeit des Schnittes erzielt, und die Messer selbst haben die Rüben nicht, wie bisher zu tragen.

Fig. 186.



Steinfänger an Rübenschnitzelmaschinen. (D. P. 18784 vom 5. Februar 1882. Lorenz Bodenbender in Bernburg.) Bei der gewöhnlichen Form des Füllrumpfes an Schnitzelmaschinen, welche durch die punktirte Linie *abcd* angedeutet ist, findet ein häufiges Zerbrechen der Schnitzelmesser durch zufällig beigemengte Steinchen statt. Die Steine können nicht

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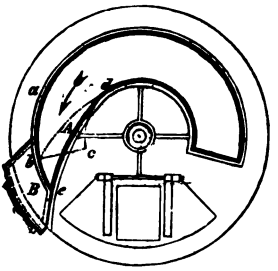
ausweichen, weil die Drehungsrichtung der Schnitzelscheibe *C* normal zur Vorlage *bc* gerichtet ist. Bei dem nach *aed* veränderten Füllrumpf ist ein Einklemmen der Steine nicht möglich, weil die neue Vorlage *A* (von *d* bis *e* reichend) nicht normal, sondern unter einem sehr kleinen Winkel zur Drehungsrichtung der Schnitzelscheibe angebracht ist. Hierdurch und durch die günstig einwirkende Centrifugalkraft erreicht man, dass die Steine, welche auf der Schnitzelscheibe liegen, durch die Scheibe selbst, an der Vorlage *A* entlang, nach *e* geschoben werden und dort in den Sammelkasten *B* fallen. Die Oeffnung ist nur so hoch, dass die grössten Steine bequem hindurchgehen, Rüben dagegen nicht hindurchgeschleudert werden können. Die gezeichnete Anordnung bezieht sich auf eine neue Schnitzelmaschine. Bei Umänderung alter Maschinen ist die schräge Vorlage nach *bd* anzufertigen.

Fig. 187.



Ueber die Leistungsfähigkeit der verschiedenen Schnitzelmaschinen und Schnitzelmesser berichtet Weiland auf der zu Hamburg am 17., 18. und 19. Mai 1883 abgehaltenen Generalversammlung des Ver. für Rübenzuckerindustrie Folgendes: Zunächst ging man nicht an eine Aenderung der Construction, sondern begnügte sich mit Verbesserung einiger Fehler: man erweiterte den Fülltrichter unten konisch oder verengerte ihn wenigstens nicht; ferner wurden die hohen Scheidewände aus dem Fülltrichter herausgenommen, sodann erhöhte man die Fülltrichter und endlich verlangsamte man die Tourenzahl der Maschine. In Oesterreich wurde man zu durchgreifenden Verbesserungen an der Schneidemaschine geführt: man vergrösserte die Schneidescheibe auf 2 m Durchmesser und verlangsamte den Gang der Scheibe dementsprechend, so dass die Tourenzahl zwischen 45 und 60 schwankt. Die Tourenzahl unserer deutschen Schneidemaschinen bei einem Scheibendurchmesser von 4 Fuss 6 Zoll beträgt im Mittel 120; doch variirt die Tourenzahl in einzelnen Fabriken zwischen 90 und 145. In der vorigen Campagne kam noch die Herbst'sche Doppelschneidemaschine*) zur Anwendung, welche das selbstthätige Reinigen der Messer durch die Rüben selbst besorgen soll. Die Resultate sind im allgemeinen befriedigend.

Von den Schnitzelmaschinen mit veränderter Construction sind zwei zu nennen: die Centrifugalschneidemaschine und der Rübenhobel; die erstere hat sich im Grossbetriebe bereits bewährt. Der Rübenhobel von Nikisch hat zwei Formen: mit auf- und abwärts gehendem Schneidegatter und mit oscillirender Schneidescheibe, beide sind aber noch nicht im Grossbetriebe thätig. Der Rübenhobel von Strnzel unterscheidet sich von dem anderen dadurch, dass die Messer in einer Ebene liegen, während sie bei Nikisch staffelförmig über einander angeordnet sind.

*) Techn.-chem. Jahrb. 1882, S. 231.

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Von den Schnitzelmessern sind folgende fünf Haupttypen zu nennen: 1. Fingermesser, welche aber mehr und mehr den leistungsfähigeren weichen. Als Vervollkommnung derselben haben sich zu Anfang der vorigen Campagne die Dachfingermesser eingeführt, welche ausgezeichnet schöne Schnitzel ergeben, aber nur halbschnittig sind und daher eine geringere Leistungsfähigkeit haben. 2. Seitenschnittmesser; sie werden mehr und mehr zurückgedrängt, die daran gemachten Verbesserungen hatten den erwünschten Erfolg nicht. 3. Die Königsfelder Messer nehmen eine sehr hervorragende Stellung ein, sie würden eine grössere Verbreitung finden, wenn sie nicht halbschnittig wären. 4. Die Dachrippenmesser von gewöhnlicher Construction geben befriedigende Resultate, wenn man die Messer nicht 3—4 mm, sondern 6—7 mm von der Vorlage entfernt einlegt, wodurch man erreicht, dass die Holzfasern und die Steinchen anstandslos durch die Messer gehen; auch bis 8—10 mm darf man gehen. Je weiter man sie jedoch entfernt, um so mehr Sorgfalt muss man auf das Hochstellen der Messer verwenden. Eine Verbesserung der Dachrippenmesser bietet a) das System Greiner, welches bezweckt, den Schnitzeln einen besseren und freieren Durchgang und der Rübe eine bessere Führung zu gewähren; b) Patent Paschen oder Patent Rassmus.*) Beide Systeme zeigen kaum Unterschiede und sind Messer mit durchgefrästen Schneiderinnen, die bei dem einen bogenförmig, bei dem anderen stumpfwinklig durchgefräst sind. Die Messer haben sich überall vorzüglich bewährt. 5. Die Arndt'schen Rübenschneidemesser mit verstellbaren Klingen und Spaltmessern sind mehrfach im Gebrauch und haben sich vorzüglich bei der Auslaugung bewährt. Die Messer waren Anfangs sehr zart und zerbrechlich, haben jedoch seitdem eine bedeutende Vervollkommnung erfahren.

Kunze führte die hauptsächlichsten Uebelstände der bisher gebräuchlichen Schnitzelmaschinen an. Es sind dies folgende: 1. Die unmittelbar auf der Schneidescheibe liegenden Rüben sind in steter Bewegung, weshalb verhältnismässig nur kurze Schnitzel, untermischt mit vielem kleinen Gehäcksel selbst bei grossen und langen Rüben geliefert werden, insbesondere wenn die Rüben im Filtertrichter zu Ende gehen; 2. ein ungleicher Druck der Rübe beim Schnitt, weshalb keine gleichmässigen Schnitzel zu erzielen sind; 3. zeitraubendes Auswechseln der Messerkasten; 4. ungenügende Leistungsfähigkeit. Alle diese Uebelstände sind durch die neue Rassmus'sche Centrifugalschnitzelmaschine beseitigt. (Deutsche Zuckerind. 1883, 587.)

Die Gewinnung des Saftes mit hydraulischen Pressen wird immer mehr verlassen und zwar auch in den Ländern, welche, wie Frankreich und Belgien, dieses Verfahren noch am längsten beibehalten hatten. In Frankreich verbreitet sich das Diffusionsverfahren (nach Stammer Zeitschr. d. Ver. f. Rübenz.-Ind. 31, 48) immer mehr, namentlich da, wo grosse Culturen gute Rüben hervorbringen, während in den Departements Nord, Pas de Calais, Somme u. A., wo die Rübe bisher noch von geringem Zuckergehalt ist und

*) Techn.-chem. Jahrb. 1883, S. 164.

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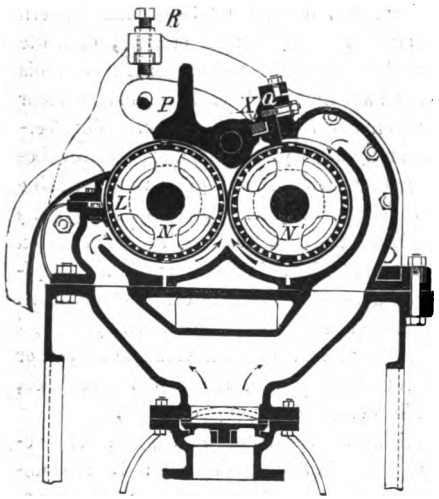
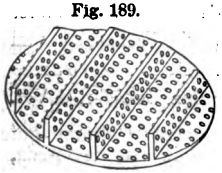
die sehr zerstreuten und verteilten Felder mancherlei Rücksichten verlangen, die Walzenpressen mehr und mehr an die Stelle der alten hydraulischen Pressen gesetzt werden. Hand in Hand damit geht die Anwendung der doppelten Pressung mit Rücklauf des Nachpresssaftes auf die Reibe, ohne welche von einer einigermaassen genügenden Saftausbeute bei keiner Walzenpresse die Rede sein kann. Namentlich wird der Dujardin'schen Presse viele Beachtung geschenkt und sind nach dem Journ. des fabricants de sucre (No. 49 vom 6. Dec. 1882) deren bereits 366 in 43 Anlagen im Betriebe. Bei dieser Presse (D. P. 18877 vom 3. December 1881) hat das von unten zugeführte Material zwischen die mit Perforirungen versehenen Walzen NN^1 und dann unter die Pressbacke P, welche mittelst Schraube R mehr oder weniger der Walze N genähert werden kann. Nach der anderen Seite zu stösst genannte Backe an eine Leiste Q, mit der sie eine zur Aufnahme der Abdichtungsschiene X bestimmte Höhlung bildet, behufs Herstellung einer durch den Druck des Breies gebildeten Dichtung, welche von dem Verstellen der Pressbacke unabhängig ist. Die Stirnwandungen der Walzen sind, ebenfalls für den Zweck der Dichtung, mit concentrischen Nuten versehen, in welche sich mit verbleibendem Spielraum Vorsprünge einer Dichtungsscheibe einlegen. Es sollen mit dieser Presse 23 — 24 Proc. Pressrückstände erhalten werden, welche sehr locker und trocken sein sollen.

Fig. 188.



Nach der Sucrerie indigène (No. 20 vom 5. December 1882) hatte der mittelst Dujardin'scher Pressen gewonnene Saft der Pressen folgende Zusammensetzung: Dichte 1·036, Zucker im Liter 75·20, Reinheit 83·93. Die Presslinge zweiter Pressung enthielten: Wasser 80·2, Zucker 3·2, Verlust 0·74 Proc. der Rüben.

Fig. 189.



Das Diffuseur-Sieb (D. P. 20601 vom 27. Juni 1882) von Bartholomäus Kodl in Radotin hat durchlöcherte, aufrechtstehende Rippen erhalten. Dieselben sollen die Circulation des Saftes vor den Schnittlingen befördern.

Verfahren zur Gewinnung der Säfte aus Zuckerrüben und die dazu erforderlichen Apparate. (D. P. 21284 vom 22. Juli 1882. Adolph Klewitz in Rjeschitza, Gouvernement Orel, und Gustav Krieger

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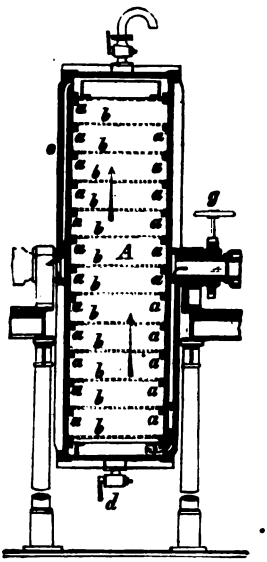
in Moskau.) Das Verfahren soll ermöglichen, die in den Rüben enthaltenen Säfte bei nahezu vollkommener Extraction des vorhandenen Zuckers mit nur ausserordentlich geringen Mengen Wasser verdünnt zu erhalten.

Ein Gefäss *A*, entsprechend einem Diffuseur, bei welchem eine der Seiten den vollkommen dicht schliessenden Deckel bildet, ist durch die Rippen *a* an den Seiten- und Bodenflächen in mehrere, etwa zwölf Abteilungen geteilt. Auf den Rippen liegen die Siebe *b*, welche aus einem gröberen Verteilungssiebe und einem feineren Filtrirsiebe zusammengesetzt sind. Diese beweglichen Siebe bilden das Charakteristische des Apparates.

Fig. 190.



Mehrere (in der Regel 5 bis 6) Gefässe *A* (Diffuseure) bilden die Batterie. Sie können in horizontaler oder in verticaler Stellung angeordnet, fest gelagert oder drehbar sein. Figur 190 stellt eine Construction dar, bei welcher das Gefäss *A* sich um zwei hohle Drehzapfen, welche zugleich die Leitungen für den Eintritt *n* und den Austritt *o* der Flüssigkeit bilden, durch ein Schraubenrad und eine Schnecke *g* horizontal oder vertical stellen lässt. Von den beiden Drehzapfen führen Canäle, der eine zur Eintrittsöffnung an dem einen Ende des Gefässes, der andere vom anderen Drehzapfen aus zur Austrittsöffnung an dem entgegengesetzten Ende des Apparates. Als Armatur trägt die Batterie wie eine gewöhnliche Diffusionsbatterie eine Leitung für das Druckwasser, eine Saftleitung zur Scheidepfanne, eine Dampfleitung mit Injector zur Regelung der Temperatur, Verbindungs- und Uebersteigrohre mit Ventilen, Thermometer, Lufthähne und Wasserablasshähne.

Die Füllung erfolgt stets in horizontaler Lage, mit dem geöffneten Deckel nach oben; man schiebt die Siebe an ihre, der Einströmung zugekehrten Rippen, füllt die Abteilungen mit den zerkleinerten Rüben, am besten Rübenbrei, und verfährt weiter wie bei der Diffusion. Aus dem zuerst beschickten Gefässe soll man bereits 48 bis 50 Proc. Saft, entsprechend einem natürlichen Rübensaft, verdünnt mit 4 bis 5 Proc. Wasser, aus dem zweiten Diffuseur schon 70 bis 75 Proc., aus dem dritten bereits den vollen Gehalt der Rübe an Saft, verdünnt mit 5 bis 6 Proc. Wasser, zur Scheidung abziehen können.

Diffusions-Doppelarmatur. (D. P. 18822 vom 3. Januar 1882. Rudolf Farkac in Prag.) Um beim Anstellen bezw. Abdrücken der Diffusoren einer Batterie stets nur den specifisch schwersten Saft zur Verarbeitung bezw. zum Uebersteigen in den nächsten Diffusor zu bringen, sind die Diffusoren mit einer Doppelarmatur versehen. Es befinden sich oben an

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dem Diffusor Wasserzuleitungs-, Uebersteiger- und Saft-Ventil; ausserdem unten an jedem Diffusor in dem Verbindungsrohr zwischem demselben und seinem Calorisator ein Dreiweghahn *g*, welcher es ermöglicht, den Saft aus dem Diffusor entweder in den Calorisator oder in das Ableitungsrohr *r* zu leiten. Beim Anstellen des Diffusors *o* gelangt der Saft, wie in Fig. 191 an-

Fig. 191.

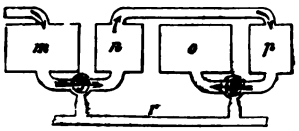
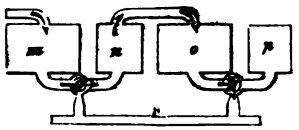


Fig. 192.



gegeben, vom Diffusor *m* durch Calorisator *n* und Calorisator *p* in den Diffusor *o*. Hier trifft er auf frische Schnitzel; er wird specifisch schwerer, z. B. schwerer als der Saft in *p*. Beim Abdrücken gelangt der Saft, wie Fig. 192 zeigt, von *m* nach *n* und *o*, und aus *o* in das Saftableitungsrohr. Calorisator *p* ist ausgeschaltet. In diesem Calorisator wird der Saft während dieser Zeit vorgewärmt. Es erfolgt nun das Anstellen des nächsten Diffusors *n*, wobei der Saft unten von *o* nach *p* und oben von *p* weiterströmt, wie in Fig. 191 für *n* gezeichnet ist.

Die Anordnung von Entluftern nach Construction Leyser*) oder Lincke nimmt immer mehr zu. Bei Vorhandensein von Gasen oder Schaum ist durch sie die normale Leistung der Batterie zu erhalten. Als ein grosser Vorzug der Entlufter wird die Sicherheit gegen Gasexplosionen und deren eingreifende pecuniäre Folgen gerühmt. (Deutsche Zuckerind. 1883, 10.)

Ueber die continuirliche Diffusion nach System Perret*) spricht sich Selwig nicht sehr enthusiastisch aus. Er erklärt, die Abdichtungen der inneren und äusseren Cylinder seien in Bezug auf die Praxis zweifelhaft. Auch sei die in dem „Journ. des fabricants de sucre" enthaltene Angabe eines Zuckergehaltes von 0·389 der Schnitzel nach seiner Ansicht mit Vorsicht aufzunehmen. Dass das Verfahren in Frankreich eine gewisse Ausdehnung erlangt habe, sei bei dortigen schlechten Rüben- und Steuerverhältnissen leicht erklärlich, der Verbreitung in Deutschland stehe jedoch die Unmöglichkeit jeder Steigerung der Leistung entgegen. (Deutsche Zuckerind. 1883, 10.)

Aufbewahrung der Diffusionsrückstände. Auf Veranlassung von Märcker (Journ. f. Landwirtschaft 1882, S. 413 u. 480; Wagner's Jahresber. 1882, 721) haben mehrere Zuckerfabriken Versuche über den Verlust der Diffusionsrückstände beim Lagern angestellt. Es wurden von 13·8 bis 54·6 Proc. der Trockensubstanz betragende Verluste während des Einmietens nachgewiesen. An diesen Verlusten beteiligten sich namentlich die stickstofffreien Extractstoffe, aber auch die stickstoffhaltigen Bestandteile. Die bisherige Annahme, dass die in heissen Säuern und Alkalien unlösliche

*) Techn.-chem. Jahrb. 1883, S. 165.

**) Techn.-chem. Jahrb. 1881, S. 231 und 1883, S. 165.

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Holzfaser gegen diese Zersetzungen geschützt sei, hat sich nicht bestätigt. Die Verluste beim Lagern sind um so grösser, je poröser das Material der Mieten und je weniger dicht die Bedeckung derselben ist. Dementsprechend verloren auch mit Strohhäcksel und Spreu eingemietete Rückstände durch das Lagern mehr als die reinen Diffusionsrückstände. Versuche, durch Zusatz von Kochsalz und dergleichen Conservirungsmittel eine bessere Haltbarkeit der Diffusionsrückstände zu erreichen, gaben unbefriedigende Resultate.

5. Scheidung des Saftes.

Verfahren zur Scheidung der Rübensäfte und anderer zuckerhaltiger Flüssigkeiten mit den Saccharaten des Strontiums in fester oder gelöster Form. (D. P. 19899 vom 12. Januar 1882, C. Scheibler in Berlin.) Bekanntlich wird das Strontiumsaccharat als ein schwer löslicher, dichter Niederschlag erhalten, der sich bei niedriger Temperatur in auskrystallisirendes Strontiumhydroxyd und in eine mit Strontiumhydroxyd gesättigte Zuckerlösung zerlegt.*) Zur Scheidung der Rübensäfte kann man sich nun sowol des in der Siedehitze ausgeschiedenen „unzerlegten“ Strontiumsaccharats direct bedienen, als auch die daraus bei der Abkühlung durch „Zerlegung“ erhaltene, von auskrystallisirtem Strontiumhydroxyd getrennte Zuckerstrontianlösung verwenden.

Die Scheidung mit Strontian ist nach Scheibler eine viel vollständigere als die mit Aetzkalk, weil die Strontiannniederschläge weit schwerlöslicher sind als die des Kalkes, und weil der Strontian eine gewisse Anzahl von Nichtzuckerstoffen fällt, die durch eine Kalkscheidung nicht entfernt werden. Infolgedessen ist der Reinheitsquotient der mit Strontian geschiedenen Zuckersäfte ganz erheblich höher, als ihn die mit Kalk geschiedenen Säfte aufweisen. Die Säfte von der Strontianscheidung sind nach Scheibler sogar unmittelbar nach der Saturation bemerkenswert reiner, als es die aus der Kalkscheidung resultirenden nach ihrer Filtration über Knochenkohle sind, so dass man bei Einführung der Strontianscheidung die kostspielige Filtration über Knochenkohle ganz oder teilweise entbehren kann.

Diese die Scheidung der Rübensäfte mit Strontian begleitenden Vorzüge treten noch in viel höherem Maasse ein, wenn man nicht mit Strontian allein, sondern mit den Strontiansacchaarten scheidet, weil letztere den Zucker in einem hohen Grade der Reinheit enthalten und dieser reine Zucker in den geschiedenen Rübensaft übertritt, dessen Reinheitsquotienten also erheblich aufbessert. Die Scheidung mit Strontiumsaccharat kann entweder durch einfaches Aufkochen, ähnlich wie bei der alten Scheidungsmethode, mit nachfolgender Kohlensäuresaturation, geschehen oder durch Kochen unter gleichzeitiger Einleitung von Kohlensäure. Man kann auch bei der Scheidung mit gleichzeitiger Saturation das Einleiten der Kohlensäure nur in beschränktem Maasse vornehmen, wobei der Saft eine starke Strontianalkalität

*) Vgl. Techn. chem. Jahrb. 1883, S. 184.

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behält, die dann erst nach der Entfernung des Schlammes durch eine zweite Saturation (Nachsaturation) beseitigt wird.

Zur Regeneration des Strontianscheideschlammes wird derselbe feucht oder nach vorherigem Trocknen, mit oder ohne Zusätze, wie Sägemehl, Kohlengrus, Teer oder dergleichen, zu Ziegeln oder Stücken geformt. Diese werden getrocknet und in Brennöfen geglüht. Man kann auch den getrockneten Schlamm zuerst der trockenen Destillation in Retorten unterwerfen behufs Gewinnung von Ammoniak, Teer und brennbaren Gasen. Es werden dann erst die in den Retorten hinterbleibenden Rückstände mit den genannten Zusätzen (Sägemehl u. s. w.) zu Ziegeln verarbeitet und geglüht.

Den Nachteil, dass die aus den Säften gefällten anorganischen und organischen Nichtzuckerstoffe, welche in der Form von Scheideschlamm einen nicht zu unterschätzenden Wert als Dünger besitzen, beim Brennen verloren gehen, kann man nach Scheibler dadurch vermeiden, dass man die Rübensäfte zunächst mit Kalk scheidet und die filtrirten Säfte einer zweiten Scheidung und Nachsaturation mit den Strontiumsaccharaten unterwirft. Diese zweite Scheidung bewirkt man am besten mit dem durch Abkühlung gewonnenen flüssigen Saccharat.

Gustav Kottmann in Berlin will als Scheidungsmittel Chlorstrontium im Verein mit Kalk oder besser mit Kalk und Chlorcalcium anwenden (D. P. 18778). Zu dem Diffusions- oder Presssaft wird zuerst Chlorcalcium hinzugesetzt, bis die Säuren, welche unlösliche Kalksalze geben, ausgefällt sind; darauf wird der Saft mit Kalk behandelt, saturirt und filtrirt. Dem filtrirten Saft setzt man Chlorstrontium hinzu, wodurch eine weitere Ausscheidung von Säuren in Form von unlöslichen Strontiumverbindungen erfolgt. Man kann auch, und zwar vorteilhafter, erst mit Chlorcalcium fällen, dann nach Filtration das Chlorstrontium anwenden und nach nochmaliger Filtration mit Kalk scheiden und saturiren. In beiden Fällen wird der Saft wie gewöhnlich weiter verarbeitet. Das Chlorstrontium wird weiter zur Reinigung von Syrupen und Nachproducten und in der Raffinerie verwendet, wobei man so lange davon den Lösungen zusetzt, als noch ein Niederschlag erfolgt.

Reinigung des Rübensaftes. (D. P. 17882 vom 27. August 1881. E. A. Schott in Kreiensen.) Dem wie bisher gereinigten Rübensaft wird, nachdem derselbe, wenn nötig, mit verdünnter Schwefelsäure neutralisirt ist, eine solche Menge Gyps zugesetzt, dass auf jedes Gewichtsteil Kali, den der Saft nach analytischer Feststellung enthält, 0·593 Gewichtsteile Kalk kommen und beides an Schwefelsäure gebunden ist. Es wird darauf eine verdünnte Auflösung von schwefelsaurem Eisenoxyd hinzugefügt, um so mehr, je mehr Gummigallerte der Saft enthält. Beim Kochen scheiden sich dann ein brauner Niederschlag, sowie blättrige Krystalle auf dem Boden bezw. der Oberfläche der Flüssigkeit ab, welche durch Filtriren des Saftes über Torfkohle abgeschieden werden. Der so gereinigte Saft wird auf bekannte Weise eingekocht, wobei sich ein dicker Schaum auf der Oberfläche abscheidet. Der darunter befindliche Saft wird in Krystallisationsgefässe abgelassen,

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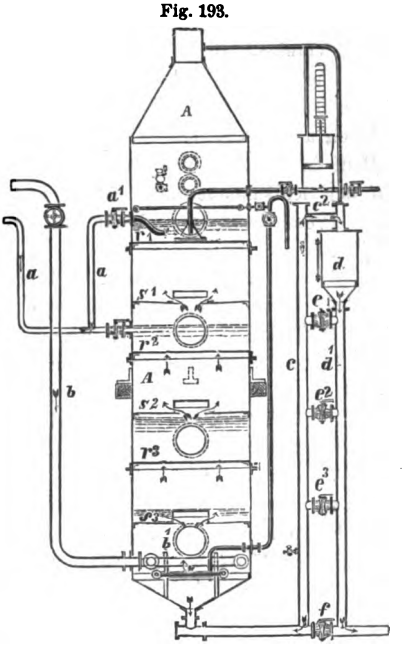
in welchen der sämtliche krystallisirbare Zucker auskrystallisirt. — Aus der durch die bisherige Fabrikation erhaltene Melasse kann durch eine der beschriebenen gleiche Behandlungsweise der krystallisirbare Zucker erhalten werden.

Aufbesserung von Rübensäften. (D. P. 18392 vom 13. September 1881. Otto Licht in Magdeburg.) Dem Rübensaft wird vor der Behandlung mit Kalk und Kohlensäure Chlorbarium zugesetzt. Es soll dadurch die Bildung von Alkalisalzen der organischen Säuren vermieden werden. Dagegen entstehen Chlorverbindungen, welche nicht wie die ersteren Melassebildner sind.

6. Saturation.

Rotirende Ausströmungsvorrichtung für Saturationsgefässe. Von Pitrof, Havelka und Meess in Karolinenthal (Zeitschr. d. d. Ver. f. Rübenz. **31**, 317). Die mit einer Spannung von 0·2 bis 0·3 Atmosphären in das Standrohr des Apparates eingetretene Kohlensäure gelangt in ein Verteilungssystem von Röhren, welche nach dem Princip des Segner'schen Rades einseitig gelocht sind. Indem die Kohlensäure durch die einseitig gelochten Oeffnungen ausströmt, wird eine Drehung des unteren Rohrsystems nach der entgegengesetzten Richtung um die Achse bewirkt und da an den längeren, unteren Ausströmungsröhren drehbare Scheiben angebracht sind, erzielt man zugleich eine horizontale und eine verticale Bewegung im Safte.

Fig. 193.



Continuirlicher Saturationsapparat mit verstellbarer Flüssigkeitssäule. (D. P. 20237 vom 7. April 1882. Fr. Lücke in Atzendorf.) In dem Gefäss *A* sind abwechselnd die Siebböden $r_1 r_2 r_3$ und Haubenböden $s_1 s_2 s_3$ angebracht. Die zu saturirende Flüssigkeit gelangt durch Rohr *a* und Hahn a^1 nach *A*. Das Kohlensäuregas strömt durch *b* in die Schlange b_1 und steigt durch die Flüssigkeitssäule in die Höhe, wobei es gezwungen ist, durch die Hauben der Böden $s_3 s_2 s_1$ und die Siebböden $r_3 r_2 r_1$ hindurchzugehen. Durch das mit Hähnen $e_1 e_2 e_3$ versehene Steigrohr *c* kann man die Flüssigkeitssäule je nach Erfordernis constant auf verschiedener Höhe halten. Soll z. B. der Spiegel der-

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selben oberhalb des Bodens r_1 gehalten werden, so bleiben die Hähne $c_1 c_2 c_3$, sowie der zum Entleeren des Saturationsgefässes dienende Hahn f geschlossen und die Flüssigkeit tritt aus dem Steigrohr c_1 durch c_2 nach d und d_1.

A. Berkefeld in Wallwitz bei Halle a. S. (D. P. 20497) bringt in Saturationsgefässen für Rübensäfte schraubenförmige, sich überdeckende oder sich ergänzende breite Flügel an verticalen Rührwerken an. Dadurch wird die Kohlensäure zurückgehalten und inniger mit dem Saft gemischt und der Rübensaft nach unten gedrückt und in Bewegung versetzt.

Verfahren zur grösseren Reinigung der Rübensäfte mittelst einer neuen Scheidungs- und Saturationsmethode. (D. P. 20597 vom 28. April 1882. Zus. zu D. P. 16268.*) A. Siegert in Tschauchelwitz.) Bei Verarbeitung von nicht gesunden Rüben wird den Rübensäften zur Scheidung nicht zweimal, sondern dreimal Kalk zugesetzt, und zwar zuerst 1 Proc. als Kalkmilch, nach dem Aufkochen 2 Proc. in derselben Pfanne und endlich ein viertes Procent Kalk, welcher in dem geschiedenen Safte abgelöscht wird. Auch bei kranken Rüben erhält man auf diese Weise trockene feste Schlämme.

7. Filterpressen.

Ueber die neueren Constructionen der Filterpressen sprachen Cizek (Hullein) und Krooc (Halle a. S.) auf der zu Oedenburg am 3. und 4. Juni 1883 abgehaltenen Generalversammlung des österr.-ungar. Rübenzucker-Vereins. Beide sind bekanntlich Erfinder von Filterpressen.

Nach Cizek sind diejenigen Pressen die besten, welche die grösste Menge Saft zu klären vermögen. Betreffs des Resultates würden diejenigen Pressen am besten den Schlamm verdrängen, welche die grösste Filterfläche hätten, da das zum Verdrängen genommene Wasser viele entblösste Stellen auf der Schlammoberfläche fände und so am besten den Saft verdränge. Seine Presse habe vor anderen den Vorzug der Billigkeit und kürzerer Dauer der Auslaugung.

Krooc macht auf seine Filterpresse mit Saftverdrängung aufmerksam und hebt hervor, dass seine Pressen ausser dem Schlammeingangscanal nur einen Wassercanal haben. In Bezug auf Leistungsfähigkeit und Concentration des Saftes seien dieselben die besten, ebenso im geringen Tücherverbrauch.

Ueber die Cizek'sche Schlammfilterpresse äussert sich J. Suchomel ebenfalls günstig. (Zeitschr. f. Zuckerind. in Böhmen 6, S. 265.)

Wie bewähren sich die verschiedenen Filterpressenconstructionen, als Auslaugungs-, Verdrängungspressen etc.? Ueber diese Frage wurde in der am 14. December 1882 abgehaltenen Sitzung des „technischen Vereines für Zuckerfabrikanten mit dem Sitz in Magdeburg“ debattirt. Der Uebelstand, dass die Auslaugung bei alten Tüchern längere

*) Techn.-chem. Jahrb. 1883, S. 167.

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Zeit in Anspruch nehme, wird dadurch erklärt, dass die Tücher sich im Gewebe zusammenziehen, dichter werden, teils verschleimen und die Capillarität verlieren. Das beste Gegenmittel sei häufiges Auswaschen und Auswechseln. In einem lebhaften Rencontre der anwesenden Filterpressen-Constructeure werden die Vorzüge jeder Construction hervorgehoben, allseitig jedoch die sichere Abführung der Luft während des Auslaugungsprocesses als unbedingt erforderlich hingestellt. Auch die Cizek'sche Filterpresse ohne Tücher wurde erwähnt und hinzugefügt, dass neuere Versuche die Erreichung dieses Zieles — ohne Tücher zu arbeiten — in nahe Aussicht gestellt hätten. (Deutsche Zuckerind. 1883, 10.)

In der am 12. Mai 1883 tagenden Versammlung des Zweigvereins für Rübenzuckerindustrie in Egeln wurde hervorgehoben, dass sich besonders Rahmenpressen durch geringeren Tücherverbrauch auszeichneten, wobei speciell die Krooc'sche Presse mit absoluter Auslaugung lobend erwähnt wurde. Als Mittel, den Tücherverbrauch bedeutend einzuschränken, wurde das Pumpen des Saftes (nicht das Drücken mittelst Montejus) empfohlen. Denn während bekanntlich der in die Pressen einströmende Dampf die Tücher am meisten beschädigt, wird dieser Umstand durch die Schlammpumpe natürlich beseitigt. Von anderer Seite wurde die Meinung vertreten, dass man auch bei Beibehaltung der Montejus dieselben Vorteile wie mit der Saftpumpe erzielen könne, wenn man nur zwischen Montejus und Schlammpresse einen Vorwärmer einschalte, wie letzteres bereits vielfach geschehen sei. Es wirke dann der Vorwärmer analog einem grossen Windkessel, der Saft trete nicht stossweise, sondern ganz gleichmässig wie bei einer Pumpe in die Presse und das Eintreten von Dampf in die letztere sei ausgeschlossen.

Ueber die Schlammpressenstation in den Zuckerfabriken. Von J. Cizek. (Zeitschr. f. Zuckerind. in Böhmen **6**, S. 140.)

Die Gewinnung von Kalk und Kohlensäure aus dem Filterpressenschlamm wurde von A. Buisson (Zeitschr. d. d. Ver. f. Rübenz. 1882, S. 604) in russischen Zuckerfabriken, welchen der Kalk sehr hoch zu stehen kommt, eingeführt. Der zu Steinen geformte und getrocknete Schlamm wird in einem Canalofen mit seitlicher Feuerung gebrannt.

8. Die Filtration.

Auf dieses Gebiet der Zuckerfabrikation ist augenblicklich die erhöhte Aufmerksamkeit der Zuckerfabrikanten gerichtet. Nachdem die Diffusion allgemein eingeführt und in Bezug auf Erhöhung des Rendements das Menschenmögliche erreicht ist, heisst die Losung „billigerer Herstellungspreis des Zuckers". Da ist es nun in erster Linie die kostspielige Knochenkohlefiltration, welche man ganz oder teilweise entbehrlich zu machen sucht.

Zunächst darf nicht vergessen werden, dass mit der durch die Diffusion ermöglichten Erhöhung der Production der Verbrauch an Knochenkohle keineswegs proportional gestiegen ist. Während man früher auf die gewonnene Füllmasse etwa das gleiche Quantum Knochenkohle rechnete, wendet

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man heute vielfach kaum die Hälfte an. Deshalb ist auch gegenwärtig die Wirkung der Knochenkohle hauptsächlich nur noch eine mechanische, keine chemische. Will man also der Knochenkohle dieselbe reinigende chemische Wirkung wie früher sichern, so muss man entweder ihre Menge entsprechend der erhöhten Production vermehren, oder man muss ihr einen Teil der Reinigungsarbeit in vorhergehenden Stationen abnehmen. Zu letzterem Auskunftsmittel hat man sich denn auch hauptsächlich gewandt und sind folgende neue Verfahren nun eingeführt: 1. Dritte Saturation mit schwefliger Säure mit nachfolgender Kiesfiltration; 2. Behandlung mit schwefliger Säure mit nachfolgender Filtration durch Rinnenfilter; 3. Behandlung mit schwefliger Säure mit Filtration durch Filterpressen; 4. Filtration durch Rinnenfilter und hierauf durch Knochenkohle.

Bei Anwendung der schwefligen Säure heisst also die Frage „Filtration durch Kies, Rinnenfilter oder Filterpressen?“ Was den Kostenpunkt dieser drei Verfahten anbelangt, so stellt sich der Preis der Kiesfiltration (nach Deutsche Zuckerind. 1883, 445) pro 1000 Centner Rüben auf $2^1/_2$ ℳ, wobei sämtliche Kosten für Füllen und Entleeren der Kiesfilter, Transport, Säuren und Waschen des Kieses eingeschlossen sind, wogegen Amortisation der Anlagekosten und der Patentprämie nicht mit eingerechnet ist. Bei Rinnenfiltration beläuft sich der Kostenpunkt auf nicht ganz 1 ℳ für das gleiche Quantum. Die Arbeit mit Filterpressen ist, ganz abgesehen von dem höheren Anschaffungspreise, teurer als diejenige mit Rinnenfiltern, aber immerhin noch wesentlich billiger als Kiesfiltration.

Die Meinungen für und wider schweflige Säure und „geschwefelten“ Zucker gelangten auf den Generalversammlungen des deutschen und österreichisch-ungarischen Vereins zu Hamburg, resp. zu Oedenburg zum Ausdrucke.

Auf der Hamburger Versammlung (Deutsche Zuckerind. 1883, 610) hob Eisfeldt (Schladen) hervor, dass bei Anwendung von schwefliger Säure die grösste Vorsicht geboten ist, da ein Hinausgehen über die Alkalität gefährliche Folgen haben würde, während bei der Knochenkohlefiltration derartiges nicht zu befürchten ist. Wenn die schweflige Säure dennoch Eingang gefunden hat, so ist dies daraus zu erklären, dass mittelst dieses Verfahrens sich der Aschengehalt der ersten Producte günstig stellt, und dass der Aschengehalt gegenwärtig beim Verkauf des Zuckers leider den Ausschlag giebt, jedenfalls weit mehr als Farbe und Korn. Referent ist der Ueberzeugung, dass derjenige Fabrikant vom ersten bis zum letzten Product die besten Resultate erhält, welcher die ausgedehnteste Filtration mit Knochenkohle anwendet. Bei ihm stelle sich der Aufwand an Knochenkohle pro Centner Rüben auf kaum 2 ₰.

Schäper (Rossla) betont dagegen die Vorteile der Anwendung schwefliger Säure zur Saturation des Dünnsaftes. Diese Operation erfordere zwar eine grössere Aufmerksamkeit, allein die erhaltene Füllmasse zeichne sich durch schöne Farbe, gutes Korn und günstigen Aschengehalt aus. Von einem

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schwefligen Geschmack des Zuckers sei keine Rede; ein Nachdunkeln finde nicht statt; die Raffinadeure haben ihr Widerstreben gegen geschwefelten Zucker aufgegeben. In Rossla seien auf die tägliche Verarbeitung von 3000 Centner Rüben bisher etwa 45 kg Schwefel verbraucht, welches Quantum aber noch auf 30 bis 35 kg ermässigt werden könne. Der Saft werde auf 0·03 Alkalität heruntersaturirt und nach erfolgtem Aufkochen durch Rinnenfilter filtrirt.

Hahne hat schweflige Säure und Kiesfiltration seit zwei Jahren eingeführt, 2 Mill. Centner Rüben danach verarbeitet und ist mit dem Verfahren in jeder Beziehung zufrieden. Barty ist für die allbewährte Knochenkohlefiltration. Denn die Saturation der Säfte mit schwefliger Säure bis auf ein Minimum von Alkalität, bis auf $^1/_{200}$, bleibt, weil sie nicht von Chemikern, sondern von Arbeitern ausgeführt wird, eine gefährliche Operation, weil der Keim zur Inversion des Zuckers dadurch gelegt werden kann.

Die Anwendung der schwefligen Säure ist, wie schon vor einigen Jahren Herbertz (Redacteur der „Deutschen Zuckerind.") auf einer Versammlung des braunschweigischen Zweigvereins warnend ausgesprochen hat, vielleicht geeignet, den Export des deutschen Zuckers zu untergraben. Wird in England erst einmal die Erfahrung gemacht, dass die deutschen geschwefelten Zucker in der Polarisation zurückgehen, so wird sich das Mistrauen bald auf sämtliche deutsche Zucker erstrecken.

Auch Bodenbender betont, dass bei Verarbeitung veränderter Rüben die Anwendung der schwefligen Säure höchst bedenklich sei. Die in veränderten Rüben enthaltenen organischen Säure bilden mit Kalk im Saft lösliche basische Kalksalze, welche das Kochen im Vacuum auf Korn erschweren. Bei Anwendung von Knochenkohle ist die Umwandlung der basischen Kalksalze in neutrale möglich, welche das Kochen nicht mehr erschweren.

Nach der bisherigen Annahme bildet die schweflige Säure mit den Farbstoffen lockere Verbindungen, welche aber schon durch die Kohlensäure der Luft zerlegt werden. Geschwefelter Zucker werde daher leicht nachdunkeln, namentlich beim Lagern in aufgeschichteten Massen, wo Wärmewirkungen eintreten. Auch kann unter dem Einfluss feuchter Luft sich Schwefelsäure bilden und Inversion veranlassen.

E. von Lippmann tritt dagegen in jeder Beziehung für das Verfahren ein.

Grothas sprach auf der Versamml. zu Oedenburg für das Verfahren der Saturation mit schwefliger Säure und nachfolgender Kiesfiltration. Die zum Spodium verwendeten Filter werden etwa bis zur Hälfte mit Kies gefüllt und braucht derselbe nur alle zwei bis drei Tage gewechselt zu werden, während bei Spodium dies alle 10—12 Stunden geschehen muss. Die Behandlung des Kieses ist einfach und fast kostenlos. Drei Mann entleeren, füllen, waschen und kochen den Kies. Der Verbrauch an Schwefel betrage 60—70 kg auf 2 500 m Rüben. (Deutsche Zuckerind. 1883, 614.)

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Ueber das Verhalten der Kieszucker beim Raffiniren. E. von Lippmann in Duisburg giebt als Vorteile des Verfahrens an: 1. die Notwendigkeit, die Saturation, also die wichtigste Saftreinigungsstation, mit einer bis dahin nicht üblichen Genauigkeit und Sorgfalt zu betreiben; 2. die vorzügliche mechanische Reinigung der Säfte; 3. den Wegfall der Absüsswässer. Die diesen Vorteilen gegenüber erhobenen Bedenken, welche Farbe, Haltbarkeit und Aschengehalt der Kieszucker betreffen, weist Verfasser als unbegründet zurück. Insbesondere geht aus den von ihm veranlassten zahlreichen Aschenanalysen hervor, dass die Kieszucker durchaus keinen abnormen Gehalt an Alkalisulfaten besitzen. (Deutsche Zuckerind. 1883, 872.)

Die Puvrez'schen Rinnenfilter*) haben den Beifall der Zuckerfabrikanten gefunden. Stammer spricht sich in der Versammlung des österreichischen Vereins (Oesterr. Zeitsch. f. Rübenzuckerind. **20**, 489) sehr günstig über diese Filter aus. Er hebt namentlich hervor, dass bisher nicht die gebührende Rücksicht auf Erzielung vollkommener Klarheit der Säfte vor der Filtration genommen worden sei. Die anscheinend klaren Säfte enthalten in allen Fällen noch feine, dem Auge nicht unmittelbar bemerkliche Trübungen, und ausserdem ist man oft nicht im Stande, bei den bisherigen Vorfiltern das Trüblaufen einzelner Tücher oder Säcke sogleich zu beseitigen. In allen diesen Fällen leidet aber die Knochenkohle sehr und wird ihre Wirksamkeit erheblich reducirt. Die vollkommen klaren Säfte der Rinnenfilter ergeben in ihrer weiteren Verarbeitung besonders günstige Resultate, da die Schlammteilchen beim Aufkochen, Verdampfen u. s. w. einen nachteiligen Einfluss deutlich zeigen.

Ueber die zweckmässigste Anlage der Rinnenfilter macht Hulwa Mitteilungen. In belgischen Fabriken habe man bis zu 50 Proc. des früher verbrauchten Quantums Knochenkohle erspart. — Während den Filterpressen die Bewältigung grosser Schlammmassen zufällt, kommt ein Ersatz durch die Rinnenfilter zur Geltung, wo es sich darum handelt, geringere Schlammabsätze, mehr oder minder starke Trübungen der Säfte wie bei der zweiten und dritten Saturation, beim eingedickten unfiltrirten, unsaturirten oder saturirten Saft zu beseitigen. Das Gesagte bezieht sich auf den Betrieb mit Knochenkohle. Aber auch in denjenigen Fabriken, in welchen die Reinigung der Säfte soweit bewerkstelligt ist, dass man die Knochenkohle ganz entbehren kann, und wo es sich dann in erster Reihe empfiehlt, die gereinigten Säfte möglichst rasch und mit Wegfall des Absüssens in die Verdampfapparate zu fördern, werden die Rinnenfilter durch die Art und die Billigkeit ihrer Anlage sich als besonders zweckmässige Filtrations-Einrichtungen bewähren.

Aus diesem Grunde hat man in Rossla bei Anwendung von schwefliger Säure zur Saturation des Dünnsaftes die Rinnenfilter eingerichtet. Bei dieser Arbeit mit schwefliger Säure und einer Rinnenfilterbatterie von drei Schläuchen kommt nicht nur das ganze Knochenkohlenhaus in Wegfall, sondern es wer-

*) Techn.-chem. Jahrb. 1883, S. 172.

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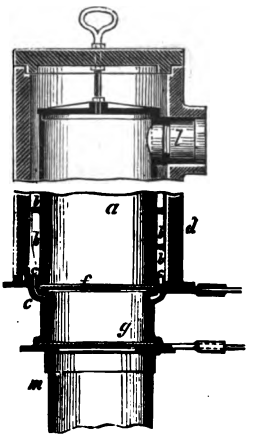
den in der Woche etwa 300 Ctr. Rüben mehr verarbeitet, und indem man zugleich eine grössere Menge Saft aus den Diffuseuren abziehen kann und die Zuckerverluste in der Knochenkohle erspart, werden $^1/_5$—$^1/_4$ Proc. Füllmasse mehr gewonnen. Ganz erheblich ist bei dieser Arbeit auch die Ersparnis an Heizkohle, sie beziffert sich circa auf einen Waggon pro Tag bei einer Verarbeitung von 3000 Ctr. Die Kosten der ganzen Anlage (schweflige Säure und Rinnenfilter) sind minimal gegenüber den bedeutenden Ersparnissen. (Deutsche Zuckerind. 1883, 472.)

9. Die Knochenkohle.

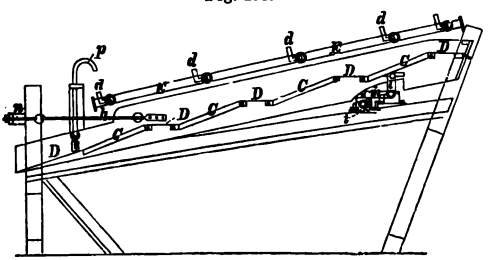
Neuerungen an Retortenöfen für Knochenkohle. (D. P. 19294 vom 1. November 1881. Jos. Nepp in Prenzlau.) Zur Aufnahme des Knochenschrotes dient ein mit Rippen *b* besetzter gusseiserner Cylinder *a*, der oben verschlossen ist und ein seitliches Rohr *l* zum Abführen der flüchtigen Producte trägt. Der Cylinder *a* ist in die Chamotteretorte *d* eingesetzt, welche von den Feuergasen umströmt wird. Die Abfüllung des gebrannten Materials geschieht, indem man zunächst den Schieber *g* und dann den Schieber *f* zieht. Wenn die Knochenkohle in den Raum zwischen *g* und *f* eintritt, entweichen die heissen Gase aus diesem durch Röhrchen *c*. Die Knochenkohle gelangt in einen Blechcylinder *m* und aus diesem in einen zweiten Blechcylinder, um hier bei Luftabschluss sich vollständig abzukühlen.

Fig. 194.



Zur Wiederbelebung der Knochenkohle (D. P. 18716 vom 29. December 1881) versieht H. Tietz in Braunschweig die in einer Reihe hinter einander liegenden Glührohre mit verschieden grossen Entleerungsöffnungen, und zwar sind die Entleerungsöffnungen der dem Feuer zunächst liegenden Rohre die grösseren und diejenigen der dem Feuer entfernter liegenden Rohre, proportional der aus denselben abzuziehenden Knochenkohlenmenge, kleiner, um bei gleichzeitigem Oeffnen und Schliessen der Entleerungsöffnungen verschieden grosse Mengen von Knochenkohle austreten zu lassen.

Fig. 195.



Stralen-Spodiumwäsche. (D. P. 17106 vom 23. October 1880. W. Ehrhardt in Quedlinburg.) Fig. 195. Das aus den Sieben *C* und Blechen

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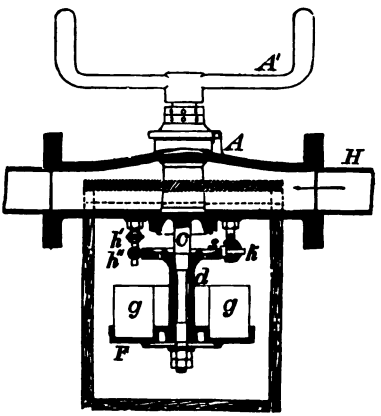
D zusammengesetzte Schüttelsieb ist an Riemen *p* aufgehängt und wird nach der einen Seite durch Dreischlag *i*, Schlagholz *m* und Arme *l*, und nach der anderen Seite durch Arme *h* und Feder *n* bewegt und durch Spritzrohr *d* berieselt.

Probenehmer für Filterabsüsswässer etc. (D. P. 20239 vom 12. April 1882. Max Müller in Gorgast bei Manschnow.) Die Abflüsse sämtlicher Filter sind an das Rohr *H* angeschlossen. Am Ende desselben befindet sich der Hahn *A*, der sich links drehend öffnet und rechts drehend schliesst und sich hierbei um 90° hin- und herbewegen lässt. Wird Hahn *A* durch Rechtsdrehung geschlossen, so nimmt die Hahnspindel *c* die Hülse *d* durch Reibung mit. Bei Linksdrehung des Hahnes (Oeffnen) bleibt die Hülse *d* in ihrer Stellung, weil eine Sperrklinke *k* in das Sperrrad *s* eingreift. An der Hülse *d* sitzt der Teller *F*, der die Probegläser *g* trägt. Bei jedem Schliessen des Hahnes *A* wird nun ein anderer Becher *g* unter das Hahnpaar *h' h''* geschoben, welche so eingestellt sind, dass die Flüssigkeit während der Zeit des Abfliessens eines Filter die Becher bis ungefähr zur Hälfte füllt. Der Arbeiter hat, wenn er einen Filterabflusshahn schliesst und einen neuen öffnet, den Handgriff *A* einmal hin- und herzubewegen.

Fig. 196.



10. Die Vacuumapparate.

In der Campagne 1882/83 hat der Schnellverdampfapparat von F. Wellner und H. Jelinek sich in vielen Fabriken eingebürgert. Es sollen im verflossenen Jahre bereits 41 Fabriken 74 Verdampfapparate dieses Systems in Thätigkeit gehabt haben. Die Form des Verdampfapparates ist eine vollständig neue. Sie ist so gewählt, dass sich eine möglichst breite und dementsprechend niedrige Lagerung der Heizrohre ermöglichen lässt, wodurch der Vorteil gewonnen ist, in einer sehr niedrigen Saftschicht eine sehr grosse Heizfläche zu erreichen und so die Bedingungen eines leichten und ruhigen Kochens zu erfüllen. Die Saftsäule des Verdampfapparates schwankt zwischen 0·5 und 0·6 m, demnach so ziemlich $^1/_4$ der bis jetzt üblichen hohen Saftstände, welche Anlass zu einem stossenden Kochen geben, das stets die Ursache von grossen Verlusten ist, um so mehr als bei den alten Apparaten der Steig- oder Brüdenraum ein abnorm kleiner ist.

Der Durchmesser der Heizrohre ist sehr klein gewählt, gewöhnlich 20 mm. In Folge dessen ist die Heizfläche des Apparates in einem bedeu-

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tend kleineren Volumen desselben untergebracht und kann man den frei werdenden Raum als Steigraum oder Brüdenraum verwenden. Da letzterer sehr gross ist, so haben die Saftteilchen, welche in dem Brüden mit fortgerissen werden, hinlänglich Zeit, sich wieder abzuscheiden und in den verdampfenden Saft zurückzufallen.

Die Heizrohre sind durch entsprechend angeordnete abgedichtete Scheidewände in den Dampfkammern in Rohrbündel geteilt, welche der Heizdampf hintereinander durchströmt. Dadurch erzielt man einen langen Weg und dementsprechend grösstmöglichste Ausnutzung des Dampfes.

Die Preise dieser Verdampfapparate sind nicht höher als die der Verdampfsapparate alter Construction. Ja, wenn die Leistungsfähigkeit der Heizflächeneinheit in Betracht gezogen wird, berechnen sie sich bedeutend billiger. Die Prüfung der Apparate auf Verdampfungsfähigkeit durch Beobachtungen im grossen ergab bei Benutzung von nur Rückdämpfen im Dreikörper eine stündliche Verdampfung von 30 kg pro Quadratmeter Gesamtheizfläche der drei Körper, was im Vergleich zu den alten Apparaten eine um 50 Proc. höhere Leistungsfähigkeit bedeutet. (Zeitschr. d. Ver. f. Rübenz.-Ind. **31**, 302.)

Krüger (Stöbnitz) behauptet (Versamml. des Zweigver. f. Rübenz.-Ind. von Halle, 8. Februar 1883), dass in Verdampfapparaten mit vertical stehenden Heizröhren diese von den Ammoniakdämpfen sehr stark angefressen werden und daher sehr oft gewechselt werden müssen, was bei den horizontalliegenden Röhren nicht der Fall ist.

Von Flüssigkeiten, die beim Erhitzen und Abdampfen einen starken Schaum bilden, welcher den Durchgang des Dampfes hindert, kann nach C. Heckmann in Berlin (D. P. 18785) der Schaum entfernt werden, indem derselbe mit erhitzten Flächen in Berührung kommt. Diese Flächen werden entweder durch ein, eine ebene Spirale bildendes Schlangenrohr gebildet, das von heissem Wasser oder Dampf durchströmt wird, oder durch Querröhren, welche durch Längsröhren verbunden sind, von denen die eine das erhitzende Medium zu-, die andere dasselbe abführt, oder endlich werden mehrere hohle Platten einerseits mit einem Zuleitungs-, andererseits mit einem Ableitungsrohr verbunden. Diese Apparate sind innerhalb des mit Flüssigkeit gefüllten Gefässes so aufgehängt, dass sie auf den Schaum herabgelassen werden können. Bei Dampfkochapparaten kann der obere Teil doppelwandig ausgeführt werden. Die Wände werden dann durch Dampf, der zwischen dieselben geleitet wird, erhitzt und bewirken dadurch das Niederschlagen des Schaums.

Während bei dem bisherigen Betrieb der Dünnsaftkörper durch Maschinenabdampf oder directen Kesseldampf, der Dicksaftkörper dagegen mittelst der aus dem Dünnsaftkörper entwickelten Brüdendämpfe geheizt wurde, wird nach dem D. P. 18764 von Alex. Herbst in Moskau die umgekehrte Anordnung getroffen. Es wird der Dicksaftkörper direct geheizt und der Dünnsaftkörper durch die Brüdendämpfe des Dicksaftkörpers erwärmt;

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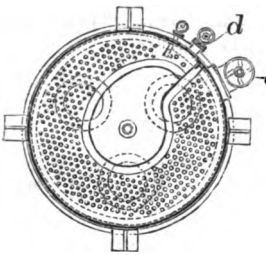
die aus dem Dünnsaftkörper entwickelten Dämpfe werden mittelst der Brüdenpumpe durch einen nassen Condensator oder einen Oberflächencondensator direct abgesaugt. Hierbei wird vermieden, dass die Ammoniakdämpfe, welche sich beim Kochen des Dünnsaftes reichlich entwickeln, in die Heizkammer des Dicksaftkörpers gelangen und ausserdem wird der Dicksaft soweit erwärmt, dass er nicht mehr vor der Weiterverarbeitung noch in den Wärmpfannen erwärmt zu werden braucht.

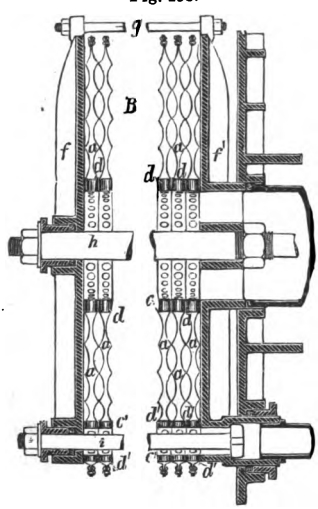
Fig. 197.



Nach dem D. P. 20963 von F. Hallström und C. Polcke in Nienburg a. S. bildet die Heizkammer stehender Verdampfapparate ein schlangenförmiges Rohr. Der Dampf tritt bei *a* in das weitere Ende und findet, im Maasse, wie er sich condensirt, durch Verengerung der Schlangenform eine immer geringere Heizfläche, bis er am engsten Teil durch das Ventil *d* als Condensationswasser seinen Ausgang findet.

Zusammenstellung der Verdampfapparate für einzudickende Flüssigkeiten. (D. P. 21163 vom 9. Juli 1882. F. Janda und J. Zednik in Konopist, Böhmen.) Um ein Entleeren des Dicksaftkörpers und damit die Bildung von Krusten an den Heizrohren zu vermeiden, wird das Dicksaftmontejus in unmittelbarer Nähe des Dicksaftkörpers und in gleichem Niveau mit demselben aufgestellt und oben und unten durch zwei mit Ventilen versehene Rohre mit demselben verbunden. Durch diese Anordnung unter Beobachtung eines eigentümlichen Verfahrens der Zu- und Ableitung des Saftes wird der genannte Zweck erreicht.

Fig. 198.



Kux in Berlin hat Neuerungen an seinem Vacuum-Verdampfapparate*) angebracht (D. P. 19649). Die Heizkörper *B* für Verdampfapparate sind durch Aneinanderreihen von Heizelementen *a a* mit dazwischen befindlicher Dichtung hergestellt. Diese Heizkörper sind zwischen gusseisernen Platten *f* und f_1, welche durch Anker *g g* und Bolzen *h* und *i* zusammengehalten werden, angeordnet. Durch Anordnung der Ringe *c c*, die in den Peripherien mit Oeffnungen *d d* versehen sind, in den Heizelementen ist im Heizkörper eine rohrähnliche Oeffnung zur Einführung des Heizmittels in diesen geschaffen. Durch Anordnung von Ringen $c_1 c_1$, die in den Peripherien mit Oeffnungen $d_1 d_1$ versehen

*) Techn.-chem. Jahrb. 1883 S. 174.

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sind, entsteht im Heizkörper eine rohrähnliche Oeffnung zur Ableitung der Condensationsproducte.

II. Die Melasse und die Zuckergewinnung aus derselben.

A. Die Elution.

Ueber die Zuckerverluste in der Elution sprach Degener in der am 18. Mai zu Hamburg abgehaltenen zweiten Sitzung der Generalversammlung des Vereins für Rübenzuckerindustrie des Deutschen Reiches. Diese Frage decke sich teilweise mit der Frage nach der Entstehung der organisch sauren Kalksalze, der Reinheit der Zuckerkalke und der grösseren oder geringeren Raschheit der Auslaugung. Entgegengesetzt der früheren Ansicht, dass ein Teil der Zuckerverluste auf die Einwirkung von organisch sauren löslichen Alkalisalzen auf den dreibasischen Zuckerkalk zurückzuführen sei, ist Degener auf Grund seiner Untersuchungen zu der Ansicht gelangt, dass die fast ausschliessliche Quelle dieser Verluste aus der Thatsache entspringe, dass bei der Einwirkung des Kalkes auf die Melasse nicht sämtlicher Zucker in unlösliches dreibasisches Saccharat übergeführt werde. Der an weniger Kalk gebundene Zucker gehe in Lösung und setze sich nun mit den Alkalisalzen zu schwer löslichen Kalksalzen und leicht löslichem Zuckerkalium. Es sei somit die Güte eines Zuckerkalkes, sowie die mit seiner Gewinnung verbundenen Verluste an Zucker abhängig von der mehr oder weniger vollkommenen Bindung des Zuckers als dreibasisches Saccharat und in zweiter Linie von dem schnelleren oder langsameren Verlauf des Auslaugungsprocesses, welcher letztere wieder abhänge von der mechanischen Structur des Melassekalkes und von den Veränderungen, welche der Nichtzucker desselben durch die verschiedenen Einflüsse bei der Melassekalkbereitung hinsichtlich seiner Löslichkeit erfahren habe. (Deutsche Zuckerind. 1883, 643.)

Schmitz (Koberwitz) beschreibt das Verfahren der Substitution als ein vorzügliches. Die wässerigen Lösungen des Zuckers haben bekanntlich je nach ihrer Temperatur die Eigenschaft, soviel Kalk aufzunehmen, dass auf 1 Tl. Zucker $^1/_3$—$^2/_3$ Tle. Kalk entfallen. Solche wässerige Zuckerkalklösungen mit 7·5 bis 8 g Zucker in 100 cbcm zeigen die charakteristische Reaction, dass sie beim Erhitzen eine Zersetzung erleiden, einerseits in als Niederschlag ausfallenden dreibasischen Zuckerkalk, in dem ungefähr die Hälfte des vorher gelösten Zuckers enthalten ist und andererseits in eine kalkarme, gelöst bleibende Verbindung mit dem Reste des Zuckers. Wird die erhitzte Flüssigkeit abgekühlt, so verschwindet der Niederschlag wieder vollständig. Diese Reaction zur Basis eines Verfahrens zur Gewinnung des in der Melasse enthaltenen Zuckers unter sehr geringen Zuckerverlusten gemacht zu haben, ist das Verdienst des Herrn Steffen.

Aus der verdünnten Melasselösung wird in erwähnter Weise der Zuckerkalk gefällt, die nach Abpressung desselben ablaufende Mutterlauge durch Melassezusatz wieder gezuckert und abermals zur Fällung eines Teiles des Zuckers benutzt u. s. f. Die Natur der Melasse kommt hierbei nicht in

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Frage, auch von osmosirter seien schon über 10 000 Ctr. in einer Anlage ohne jede Schwierigkeit verarbeitet worden. Hilfsmaterialien bei der Substitution sind: Wasser, Kalk, Kohle und Presstücherstoffe, die neben dem Vorzuge der Billigkeit und leichten Beschaffung noch den grossen der vollen Gefahrlosigkeit besitzen. Als Hauptoperationen des Verfahrens sind zu nennen:

1. Herstellung des fertigen Ansatzes. Hierzu dient die Mutterlauge, also der gemischte Ablauf der Roh- und Reinsaccharat-Filterpressen. Dieselbe ist zu zuckern, zu kühlen, zu kalken und endlich zu klären. Die Zuckerung erfolgt durch Zusatz von Melasse in die durch Abscheidung des festen Saccharates zuckerarm gewordene Mutterlauge, und ist hierbei der Normalgehalt von 7—8 g Zucker in 100 cbcm festzuhalten. Diese Operationen — die Substitution — wird im Substitutions-Rührgefässe vorgenommen, Die substituirte, heisse Lauge wird alsdann durch Neubecker'sche Apparate auf 18—22° C. abgekühlt, jedoch genügen schon 28° zu noch guten Zuckerkalkfällungen. In der Kalkung wird nun der Lauge ca. 50 Proc. des Zuckergehaltes Kalk in Form von Mehl im Maischgefäss zugesetzt. Die Klärung erfolgt in mit Auslaugevorrichtung versehenen Dehne'schen Kalkschlamm-Pressen, welche mit Automat-Pumpe beschickt werden. Der Ablauf dieser Pressen, die geklärte, fertige Ansatzlauge sammelt sich in Reservoirs. Der in den Pressen verbleibende feste Kalkschlamm wird nach seiner Absüssung als Dünger verwendet.

2. Darstellung des Reinsaccharats. Erhitzen des Ansatzes auf 110°, Trennung des Niederschlages (Rohsaccharates) von der Mutterlauge durch Pressung I., Reinigung desselben mittelst kochenden Wassers, Trennung des gereinigten Saccharates von der Waschlauge durch Pressung II., endlich Darstellung des Saccharatbreies. Um an Kosten zu sparen, geht der Erhitzung des Ansatzes eine Vorwärmung desselben in einem Röhrenvorwärmer voraus, dessen Heizung durch Retourdampf erfolgt. Direct vom Kochen werden alsdann die ersten Filterpressen, die Vorpressen beschickt. Ihr Ablauf gelangt in das Mutterlaugenreservoir, ihre Kuchen durch geheizte Transportschnecken nach der Rohsaccharatmühle. In derselben werden sie zerrieben und unter Zufluss von kochendem Wasser gemischt. Das Wasserquantum beträgt ca. 150—170 Proc. des Rohsaccharates. Die Reinigungswirkung des heissen Wassers besteht in einer Verdrängung bezw. Verdünnung der noch vorhandenen Mutterlauge. Von der Mühle wird das hergestellte Gemisch zur Vermeidung der Lösung des Zuckerkalkes möglichst schnell in die Nachpressen mittelst Montejus gedrückt. In denselben bleibt der feste Reinsaccharatkuchen zurück, während der Ablauf wieder zur Mutterlauge geht. Diese letztere Kuchen gelangen nun wieder durch Schnecke nach der Reinsaccharat-Mühle, werden in ihr zerrieben und entweder mit Rohsaft oder Filterabsüsswasser zu einem Brei von 50—60′ Bx. gemischt. Dieser Brei kommt zur Scheidestation der Saftfabrik und erfolgt dort unter Innehaltung besonderer Vorschriften der Zersetzung entweder in Gegenwart

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von Rohsaft oder bei directer Arbeit unter Zusatz von Wasser. Die weitere Verarbeitung ist die bekannte. Die resultirende Mutterlauge geht in den Betrieb zurück.

3. Normirung des Laugenbestandes. Die Quantität der Laugen unterliegt während des Betriebes einer steten Schwankung. Vermindert wird dieselbe durch die Entnahme des Reinsaccharates, andererseits jedoch bedeutend vermehrt durch den Zusatz an Melasse und Waschwasser. Demgemäss muss notwendig die Entfernung eines Teiles aus dem Turnus erfolgen. Dabei darf die abzugebende Lauge keinen oder nur wenig Zucker enthalten und ist ein Zuckergehalt von unter 2 Proc. auch erreicht worden. Zu dem Ende wird die auszuschaltende Mutterlauge nicht mehr mit Melasse substituirt, sondern nach der Kühlung mit der entsprechenden Kalkmenge versetzt, geklärt, erhitzt und gepresst. Durch diese erste Reduction ist der Zuckergehalt der Mutterlauge vermindert worden. Nach einer zweiten Reduction resultirt dann die als Dünger zu verwertende Endlauge. Die Quantität der Abfalllauge hängt von der Waschwassermenge zumeist ab. Auf 67 hl substituirter Lauge entfielen bei 170—175 Proc. Waschwasser 16·1 hl erste und 16·5 hl zweite Reductionslauge.

Nach der beschriebenen Arbeitsweise ist der Betrieb der Substitution ein äusserst einfacher und glatter. Die Zuckerverluste sind durchweg sehr gering. Auf 100 Gewichtsteile Melasse mit 50 Proc. Zucker ergab der Campagnedurchschnitt im ganzen 5·5 Gewichtsteile Zuckerverlust. Davon entfielen auf die Abfalllaugen 4·7, auf den Kalkschlamm 0·8 Gewichtsteile Zucker. (Deutsche Zuckerind. 1883, 843.)

Ueber das neuentdeckte „Ausscheidungsverfahren“ von Steffen teilt E. von Lippmann mit, dass dasselbe bereits in Gandersheim und Sarstedt probeweise eingeführt sei. Es soll die sofortige Ausfällung des in einem Saft enthaltenen Zuckers herbeiführen und besteht darin, dass einem bereits mit Kalk gesättigten Saft, unter Befolgung gewisser Vorsichtsmaassregeln, neue Quantitäten Kalk zugeführt werden. Es kommt dabei auf möglichst feine Verteilung des Kalkes an; ferner darf eine gewisse Consistenz der Lösung und ebenso eine gewisse Temperatur nicht überschritten werden. Auf diese Weise gelingt sofort beim Einbringen des Kalks, beim blossen Umrühren auf kaltem Wege eine Ausscheidung des Zuckers in Form des dreibasischen mit etwas überschüssigem Kalk vermischten Saccharats, die so weit getrieben werden kann, dass schliesslich die in der Melasse enthaltenen linksdrehenden Substanzen hervortreten und eine Linkspolarisation veranlassen. Das so erhaltene Saccharat unterscheidet sich von dem bisher bekannten äusserst vorteilhaft dadurch, dass es eine körnige Structur besitzt, sich leicht von der Mutterlauge trennen und in vorzüglicher Weise auswaschen lässt. (Deutsche Zuckerind. 1883, 643.)

Ein neues Melasse-Entzuckerungsverfahren haben Fr. Schmalbein in Köln und W. Wolters erfunden. Das Verfahren beruht darauf, dass das Calciumoxyd andere, an Kalk reichere Saccharate liefert als

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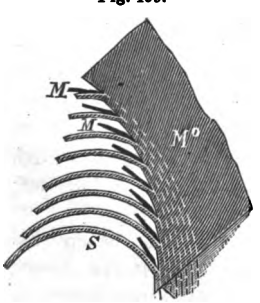
das Kalkhydrat. Mit dem von Hydrat freien Calciumoxyd lässt sich die Verbindung von 1 Atom Zucker mit 4 Atomen Kalk erzeugen, welche unlöslich in Wasser ist. In Gestalt dieser unlöslichen Verbindung kann der Zucker aus allen unreinen Lösungen — Melassen, Syrupen, Pflanzensäften — erhalten werden. Um hydratfreies Oxyd zu erhalten, wird der Kalk durch Brennen, resp. Nachbrennen bei Gelbglut in schwer sich löschenden Kalk übergeführt, welcher sich leichter mit Zucker als mit Wasser verbindet. Da jedoch der Kalk in Pulverform zu verwenden ist und bei der Pulverung die Feuchtigkeit nicht ganz ferngehalten werden kann, so ist es zweckmässig, die Zerkleinerung anfangs nur grob auszuführen und die wesentlich feinere Pulverisirung im Gemenge mit der Zuckerlösung vorzunehmen.

Beachtenswert ist, dass sowol der bei Hellrotglut als bei Weissglut gebrannte Kalk unfähig ist, den Zucker als vierbasischen Zuckerkalk auszufällen. Dagegen fällen selbige den Zucker als achtbasische Verbindung. (Deutsche Zuckerind. 1883, 593 und 618.)

Verfahren zur Zuckergewinnung aus alkoholischen Lösungen von Melasse und Syrup. (D. P. 17919 vom 13. März 1881. W. Gundermann in Heilbronn.) Die Melasse wird mit dem $1^1/_2$—2fachen Quantum Spiritus verdünnt. Der Mischung werde 3—6 Proc. einer concentrirten Chlorcalcium-Lösung zugesetzt. Der Niederschlag wird abfiltrirt, die Lösung durch Einleiten von Kohlensäuregas entkalkt. Um eine Lösung des Carbonats durch überschüssige Kohlensäure zu verhüten, wird mit dem Chlorcalcium auch etwas Aetzkalk, 0·5—2 Proc., zugesetzt. Beim Eindampfen der filtrirten Lösung im Vacuum krystallisiren vor Ausscheidung des Zuckers grosse Mengen Chlorkalium und Chlornatrium aus.

Die Reinigung von Rüben- und Rohrzucker-Melasse führt W. Gundermann nach dem D. P. 19091 vom 19. August 1881 folgendermaassen aus: Nachdem der wässerigen Melasselösung saurer phosphorsaurer Kalk und Chlorcalcium (durch Auflösen von Knochenkohle oder Phosphorit in Salzsäure erhalten) und darauf Kalkmilch bis zu schwach alkalischer Reaction zugesetzt worden ist, bildet sich ein Niederschlag von basisch phosphorsaurem Kalk und organischsauren Kalksalzen, welcher entfernt wird. Erst nach Entfernung dieser Melassebilder wird zur Darstellung von Melassekalk geschritten.

Fig. 199.



Schneidemaschine für plastischen Melassekalk. (D. P. 21532 vom 27. Mai 1882. J. Brandt & G. W. von Nawrocki in Berlin.) Während bei den gebräuchlichen Schneidemaschinen die Schneiden der Messer alle in demselben Kreise liegen und daher, mögen dieselben auch noch so zahlreich sein, immer nur ein Messer zu derselben Zeit schneidet, sind hier an dem Umfange der Trommel dreimal acht Messer *M* dicht hintereinander derartig angeordnet, dass ihre

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Entfernung von der Achse der Trommel von Messer zu Messer um die Dicke der Schnitzel S des Melassekalkklotzes M^0 zunimmt.

B. Das Strontian-Verfahren.

Ueber die praktische Anwendung seines Strontian-Verfahrens*) macht Scheibler Mitteilungen (Neue Zeitschr. f. Rübenzuckerind. 1882, 8), denen wir Folgendes entnehmen.

In der Zuckerraffinerie Rositz bei Altenburg geschieht die Fällung des Zuckers als schweres, sandiges, sich leicht absetzendes Strontiumsaccharat in offenen Pfannen, welche mit einem Rührwerk und am Boden mit einer offenen Dampfschlange versehen sind. Von der 10- bis 13proc. Strontianlösung wird eine bestimmte Menge unter fortwährendem Kochen, durch Zugabe krystallisirten Strontiumhydrates in den Pfannen auf eine Concentration von etwa 20—25 Proc. gebracht. Alsdann giebt man ungefähr die Hälfte der zu verarbeitenden Melasse zu, verstärkt das Kochen, fügt demnächst unter fortdauerndem Umrühren das noch fehlende Strontiumhydrat zu, um nach geschehener Auflösung desselben die andere Hälfte der Melasse ebenfalls einzutragen und schliesslich noch durch weiteren Zusatz von Strontiumhydrat die Alkalität der Flüssigkeit auf 12 bis 14 Proc. zu bringen. Wenn man bei dieser Reaction auf 1 Tl. Zucker der Melasse ungefähr 2·5 Tl. $Sr^3O^3H^2 \cdot 8H^2O$, d. i. auf 1 Aeq. Zucker der Melasse etwas mehr als 3 Aeq. Strontiumhydrat verbraucht hat, so ist der Zucker der Melasse so vollständig als Strontiumsaccharat ausgefällt, dass die davon abfiltrirten Nichtzuckerlaugen bei der Polarisation nur noch 0·3 bis 0·8 Proc. Zucker zeigen. Die Art, das Strontiumhydrat und die Melasse in zwei und mehr Fractionen statt auf einmal in die Fällungspfannen einzutragen, hat den Vorteil, dass alsdann die ganze Reaction sich in einer viel geringeren Gesamtmenge von Flüssigkeit, also in einer bedeutend concentrirteren Lösung vollziehen lässt.

Die Fällungspfannen der Rositzer Zuckerfabrik sind so gross, dass sie leicht bis zu 300 kg Melasse in einer Operation zu verarbeiten gestatten. Zur Verdünnung dieser Melasse werden bis etwas über 3 l der erwähnten Strontianlösung für 1 kg Melasse aufgewendet und der überdies erforderliche Aetzstrontian in der Form krystallisirten Salzes zugegeben. Die fertiggekochte Masse gelangt auf die Vacuumfilter, wo die Mutterlauge durch Absaugen vom ausgeschiedenen Saccharat getrennt wird. Erscheint das Saccharat an seiner Oberfläche trocken, so wird der Hahn zur Luftpumpe abgestellt und der Luftzulasshahn, sowie demnächst der Ablaufhahn am tiefsten Punkte geöffnet, worauf die abgesaugte Nichtzuckerlauge in die untere dafür bestimmte Rinne abfliesst und aus derselben in besondere Krystallisationsgefässe zum Auskrystallisiren des Strontianüberschusses sich ergiesst. Das auf dem Filter befindliche Saccharat wird mit heissem Wasser oder zweckmässiger mit einer sehr heissen 10proc. Strontian-

*) Techn.-chem. Jahrb. 1883, S. 183.

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lösung ausgewaschen. Die hierdurch sich ergebende Decklauge wird wieder an Stelle der 10proc. Strontianlauge in die Kochpfannen geleitet; sie enthält 10—12 Proc. Strontian und 0·2—0·7 Proc. Zucker, welche also nicht verloren gehen, da die Lauge in den Rundbetrieb zurückkehrt.

Das auf dem Absaugefilter befindliche Saccharat ist meist nach einmaliger Waschung rein. Ist eine herausgehobene Probe des Filterkuchens nicht schwach strohgelb bis weiss, sondern zeigt braune Streifen, so wird eine zweite Decke gegeben. Bei den Arbeiten in dieser Station sind die Massen und Decklaugen so heiss wie möglich zu halten und darf die Masse zumal in der Zuflussrinne nicht zu lange stehen, oder gar darin erkalten. Das auf den Absaugefiltern hinterbleibende reine Saccharat wird mit flachen Holzschaufeln in einzelnen Stücken von dem Filtertuche abgehoben und in länglich flache, viereckige Kasten eingelegt, welche an beiden Enden mit Handgriffen zum Zu- und Abtragen versehen sind. Ehe die Saccharatstücke in die Kasten eingelegt werden, giebt man etwas Wasser in letztere, um Boden und Wände derselben anzufeuchten, damit das Saccharat nicht anhaftet.

Nach Einfüllung des Saccharats, welches höchstens die halbe Höhe der Kasten einnehmen soll, wird dasselbe mit kalt gesättigter, d. h. etwa 2proc. Strontianlösung übergössen, bis es davon möglichst überdeckt ist. Die so beschickten Kasten werden nun je nach den Umständen in der Zahl von 30—60 Stück auf besonders dazu construirten Wagen in Reihen neben- und übereinander gestellt und die beladenen Wagen auf Schienen in die Canäle des Kühlhauses geschoben. Dieses besteht aus längeren Canälen, welche im Winter leicht kühl zu erhalten sind, indem man kalte Luft einströmen lässt, welche möglichst trocken sein soll, um die Verdunstung des Wassers und damit die Wärmeverbindung zu fördern. Für den Sommerbetrieb sind Vorrichtungen zu einer künstlichen Abkühlung der Canäle zu treffen. Die geeignetste Temperatur für die Kühlkammern ist die von + 10° und darunter, höchstens aber etwa 12°. Die erforderliche Zeitdauer für die völlige Zerlegung des Saccharates in Strontiankrystalle und strontianhaltige Zuckerlösung schwankt mit der Temperatur des Kühlhauses. Im günstigsten Falle beträgt sie 24 bis 36 Stunden, im weniger günstigen Falle bis zu 72 Stunden. Man findet alsdann in der Flüssigkeit ein zusammenhängendes Haufwerk von krystallisirtem Strontianhydrat. Die Strontianmenge, welche man so in krystallisirter Form für eine neue Operation wieder gewinnt, beträgt ungefähr die Hälfte der ursprünglich im Saccharat vorhandenen. Durch ein Siebfilter wird der ausgeschiedene Strontian von der strontianhaltigen Zuckerlösung getrennt. Letztere wird der ersten Saturation zugeführt. Man saturirt mit der Kohlensäure der Strontianit-Brennöfen, in welchen der aus den Filterpressen hervorgehende Schlamm von kohlensaurem Strontian zu Strontian regenerirt wird. Man saturirt, bis 0·04—0·06 Strontian im Safte noch vorhanden ist. Der durch die Filterpressen filtrirte Saft geht zur zweiten Saturation, während die Absüsswässer nach ihrer Abkühlung zum Abwaschen der Strontiankrystalle des zersetzten Saccharates verwendet werden.

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Verfahren zur Abscheidung des Zuckers aus Melassen und Syrupen durch Erzeugung von Strontianzucker bei niedrigen Temperaturen. (D. P. 22000 vom 29. April 1882. C. Scheibler in Berlin.) Eine heiss bereitete Lösung von Monostrontiumsaccharat bleibt nach dem Erkalten längere Zeit übersättigt. Während sie der Ruhe überlassen oder durch Zusatz von etwas Strontianhydrat zur Krystallisation angeregt wird, krystallisirt Strontianhydrat aus; beim Umrühren, besonders aber bei gleichzeitiger Zuführung einer kleinen Menge Monostrontiumsaccharat zur Anregung der Krystallisation scheidet sich dieses in warzigen, aus einem feinkörnigen Pulver bestehenden Massen aus. — Man löst $^1/_2$ kg Strontianhydrat $Sr(OH)^2+8H^2O$ in $1^1/_2$ kg kochendem Wasser, mischt unter Umrühren 1 kg Melasse (annähernd entsprechend der nach der Theorie erforderlichen Menge Zucker) hinzu, lässt die fast klare Melasselösung erkalten, rührt sie anhaltend oder zeitweilig unter Zufügung einer kleinen Menge Monostrontiumsaccharat um, trennt das nach 12 bis 24 Stunden sich ausscheidende, mit der Mutterlauge einen dicken Brei bildende Monostrontiumsaccharat ($^2/_3$ bis $^3/_4$ der theoretischen Ausbeute) von derselben durch bekannte Apparate und wäscht es mit Wasser oder einer kalt gesättigten Lösung von Strontianhydrat aus. — Um den noch in der Nichtzuckermutterlauge gelöst gebliebenen Zucker zu gewinnen und so eine Ausbeute bis zu 96 bis 97 Proc. der theoretischen zu erhalten, wird derselbe aus ersterer nach Zusatz von Strontianhydrat in starkem Ueberschusse durch anhaltendes Kochen als Bistrontiumsaccharat ausgefällt. Der alsdann noch gelöste Strontian wird durch Ausfällung mit Kohlensäure wieder gewonnen. Die dann bleibende letzte Lauge wird nicht weiter auf Zucker verarbeitet. Aus dem noch mit Mutterlauge durchtränkten Bistrontiansaccharat wird durch Auflösen in kalter Melasse und Zusatz einer heiss gesättigten Lösung von Strontianhydrat wieder eine Lösung von Monostrontiumsaccharat hergestellt, aus der dasselbe in der früher beschriebenen Weise gewonnen wird. Die Melasse soll, nach diesem Verfahren verarbeitet, fast vollkommen in Monostrontiumsaccharat einerseits und fast zuckerfreie Abfalllauge andererseits zerlegt werden. Die Abscheidung des Zuckers aus Monostrontiumsaccharat, geschieht in bekannter Weise, oder indem man zunächst erst noch einen Teil des Strontians als Strontianhydrat abscheidet, um ihn zu neuen Fällungen zu benutzen. Löst man nämlich das Saccharat in heissem, jedoch nicht kochendem Wasser und lässt die filtrirte Lösung langsam, ohne umzurühren, erkalten, so krystallisirt ein Teil des Strontians als Strontianhydrat wieder aus.

Das in der Siedehitze aus Melassen oder Syrupen gefällte Strontiumsaccharat soll nach Scheibler's D. P. 19339 in compacten Massen für sich, ohne Wasserzugabe, erkalten und sich in Zuckerlösung und Strontianhydroxyd zersetzen. Diese Massen werden alsdann in geeigneten Kästen mit Siebböden einer systematischen Auslaugung mit kaltem Wasser nach dem Gegenstromprincip unterworfen. Diese Zerlegung des Strontiansaccharates kann auch durch Ausschleudern in Centrifugen bewirkt werden.

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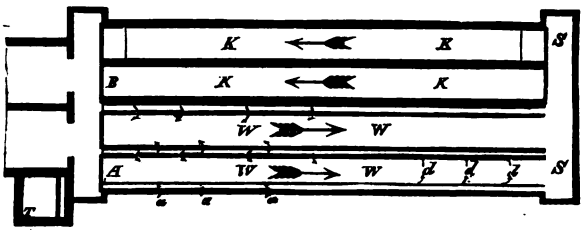
Um einer Wiederauflösung des durch Kochen gefällten Zuckerstrontians vorzubeugen, wird derselbe nicht mit heissem Wasser, sondern mit heisser Strontianlauge ausgewaschen. Die Waschflüssigkeit kann wieder zur nächsten Fällung benutzt werden. (D. P. 22213 der Dessauer Zucker-Raffinerie und C. Scheibler.)

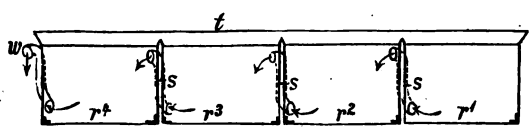
Vorrichtung zur systematischen Abkühlung des Strontiansaccharates. (D. P. 22242 vom 11. August 1881. Dessauer Actien-Zucker-Raffinerie in Dessau.) Die Krystallisationskästen, in denen das Strontiumsaccharat und die Lauge sich befinden, werden auf Wagen, welche bei *A* eintreten, durch die Warmcanäle *W* und sodann über die an dem anderen Ende befindliche Schiebebühne *S* durch den Kaltcanal hindurchgeführt. Die Wagen mit den darauf stehenden Kästen füllen die Canäle beinahe ganz aus, so dass nur kleine Räume für die Circulation der Luft übrig bleiben. Im Winter wird zur Kühlung nur die natürliche Luftcirculation durch seitliche Oeffnungen *a* und an der Decke angebrachte Schlote benutzt. Im Sommer wird die Luft zur Abkühlung durch Verdunstung durch einen mit feucht gehaltenen Reisig gefüllten Kühlturm *T* geleitet. Der Kaltcanal wird durch eine Rohrleitung, in welcher kaltes Wasser oder durch Eismaschinen gekühlte Salzlösung circulirt, oder durch ganz geschlossene, mit Eis gefüllte Behälter oberhalb des Canales gekühlt.

Fig. 200.



Bei dem Auswasch-Apparat für Strontiumsaccharat (D. P. 20873 vom 26. Juli 1882) der Zeitzer Eisengiesserei- und Maschinenbau-Actien-Gesellschaft ist eine Anzahl Siebkästen kreisförmig angeordnet, welche eine auf- und abgehende oscillatorische Bewegung erhalten und in kreisförmig gruppierte Auswasch- bezw. Trennungsgefässe tauchen. Zugleich werden die Siebkästen gegen die Auswasch- oder Trennungsgefässe, oder umgekehrt die letzteren gegen die Siebkästen um einander verdreht, so dass die auszuwaschenden oder abzuscheidenden Körper je nach dem Grade der Auswaschung mit mehr oder weniger concentrirter Auswaschflüssigkeit in Berührung kommen. Die Bewegung der Auswaschflüssigkeit in den Gefässen r^1 bis r^4 ist aus Fig. 201 ersichtlich. Die Flüssigkeit in dem Gefäss r^1 enthält am wenigsten Saft. Die infolge Aufnahme von

Fig. 201.



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Saft schwerer gewordenen Flüssigkeitsteile sinken zu Boden und gelangen durch das Rohr *s* in das zweite Auswaschgefäss r^2, woselbst die Flüssigkeit weiter angereichert wird. Die concentrirte Auswaschflüssigkeit verlässt bei *w* die Gefässbatterien. Die Auswaschflüssigkeit bewegt sich den Siebkästen entgegen, so dass die am meisten mit der Lösung behafteten Krystalle von der am meisten angereicherten Flüssigkeit ausgewaschen werden.

Ueber das Vorkommen und die Gewinnung des Strontianits in Westfalen macht E. Venator Mitteilungen. (Bg.- u. hüttenm. Zeitung.)

C. Osmose.

Das E. Löw'sche Entlastungspapier zur Osmose besteht darin, dass das gebräuchliche Pergamentpapier in den Osmose-Apparaten entweder ein- oder beiderseitig mit eigens für diesen Zweck erzeugtem Papier überdeckt und so in den Osmose-Apparat eingefügt wird.

Die Erfahrung lehrt, dass bei der Osmosearbeit nicht nur die mechanischen Verunreinigungen des Wassers, sondern auch die durch das Erhitzen desselben sich ausscheidenden fixen Bestandteile auf dem Pergamentpapier abgelagert werden, dass sich die meisten suspendirten Verunreinigungen, die meisten kalkigen und schleimigen Niederschläge, Fäserchen etc. aus der Melasse am Pergamentpapier absetzen, wodurch dieses zuweilen schon nach 3—5 Tagen brüchig und unbrauchbar wird. Diese Entlastungspapiere nehmen nun alle angeführten mechanischen Verunreinigungen aus der Melasse und dem Wasser auf, bewirken eine Filtration im Osmose-Apparte selbst und ermöglichen hierdurch, dass das Pergamentpapier längere Zeit gut wirkend erhalten bleibt, was eine seltenere Auswechselung des Pergamentpapieres, somit eine Verminderung des Papiercontos bei der Osmose und ganz besonders die Erlangung eines gleichmässig guten Reinheitsquotienten bei der Osmosearbeit zur notwendigen Folge hat. (Zeitschr. d. Ver. f. Rübenzucker-Ind. **32**, 320.)

An ihrem Osmoseapparate*) haben Selwig und Lange Neuerungen angebracht (D. P. 17433). Dieselben bestehen 1. in der Anwendung von Spiralen, welche zur Unterstützung des Pergamentpapieres in den Rahmen von Osmoseapparaten gespannt sind, und 2. in einer Einrichtung an Vierweghähnen zur Umschaltung des Wasser-Ein- und Melasse-Auslaufes oder des Melasse-Ein- und Wasser-Auslaufes, welche es ermöglicht, durch dieselben den Wasser-Einlauftrichter gleichzeitig mit den beiden oberen Circulationscanälen oder den Melasse-Einlauftrichter gleichzeitig mit den beiden unteren Circulationscanälen in Verbindung zu setzen.

Ueber die Resultate bei mehrmaliger Osmose und Wiederosmose in einer französischen Fabrik, sowie über die Menge und Zusammensetzung der dabei durch Auskrystalliren der Abwässer entfallenden Salze hielt Druelle einen Vortrag in der Generalversammlung zu St. Quentin. (Stammer's

*) Techn.-chem. Jahrb. 1883 S. 185.

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Jb. 1882, 334.) Verarbeitet wurden 557 760 kg Syrup vom zweiten Product, davon Auslieferung (ohne Osmose) am dritten Product auf 16 Proc. 89 232 kg Zucker geschätzt waren. Erhalten wurden in erster und zweiter Osmose zusammen 136 492 kg Zucker (Polarisation nicht angegeben, nur Wertschätzung 60 Fr. die 100 kg), ferner 17 350 kg Salze (Wert 35 Fr. die 100 kg), ausserdem 159 750 kg Nachmelasse (zu 13 Fr. die 100 kg) und 24 000 kg Salzmelasse (zu 6 Fr. die 100 kg). Die Salze waren dreierlei Art, nämlich 6400 kg von erster Osmose, 6950 kg von erster und 4000 kg von zweiter Wiederosmose; sie waren sämtlich aus den betreffenden Lösungen auskrystallisirt und abgeschleudert. Ihre Zusammensetzung war folgende:

	vor der ersten Osmose	vor der ersten Wiederosmose	vor der zweiten Wiederosmose
Salpetersaures Kali	76·080	67·890	28·060
Schwefelsaures Kali	1·350	1·050	2·100
Chlorkalium	4·378	15·410	49·732
Chlornatrium	4·578	1·964	1·340
Organische Beimengungen	5·464	7·516	8·088
Zucker	4·210	2·670	3·480
Wasser	4·000	3·500	6·500
Kalk	Spuren	Spuren	0·700
Handelswert für 100 kg	45·82 Fr.	44·50 Fr.	33·07 Fr.

Hieraus wurde ein Dünger durch Mischen mit Superphosphat bereitet, der folgende Zusammensetzung hatte:

Kali 13·124, Gesamtstickstoff 3·780, lösliche Phosphorsäure 3·840, unlösliche Phosphorsäure 2·816, Wasser 9·400, Gyps u. s. w. 67·040.

D. Allgemeines über Melasseverarbeitung.

Ueber die moderne Zuckergewinnung aus Melasse. Von G. Lustig. (Zeitschr. d. Vereins f. Rübenzuckerind. **32**, 796—846.)

Beurteilung der Melasse: Entzuckerungsverfahren. Von Bodenbender. Ein auf der Magdeburger Generalversammlung in 1882 gehaltener Vortrag. (Zeitschr. d. Vereins f. Rübenzuckerind. **32**, 568.)

Beide Arbeiten sind für Alle, welche sich auf diesem Gebiete orientiren wollen, sehr beachtenswert. Die erstgenannte bespricht die einzelnen Verfahren in sachgemässer Weise, während der Bodenbender'sche Vortrag hauptsächlich auf den Uebelstand hinweist, dass die Melasse-Entzuckerungsverfahren an dem Fehler leiden, combinirte Verfahren zu sein. Sie verarbeiten die Melasse in Verbindung mit dem Rübensafte, wodurch wir zwei unbekannte Grössen in der Rechnung erhalten.

12. Herstellung und Verarbeitung von Rohzucker und raffinirtem Zucker.

Zur Entfernung des Syrups von den Zuckerkrystallen benutzt W. Fischer in Osterhausen (D. P. 20833) nicht die Centrifuge, sondern com-

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primirte Luft. Dies geschieht in Gefässen, welche, mit Dampf oder Heisswassermänteln umgeben, an ihrem oberen Ende vollständig geschlossen sind und unten vor der Abflussöffnung einen sehr feinen Siebboden besitzen. An denselben ist eine Armatur zum Anschluss der comprimirten Luft und zur Zuleitung von Klärsel oder schwefliger Säure angebracht.

Zur Klärung von Syrupen und nachfolgender Reinigung des Klärmittels verwendet G. A. Drumond in Montreal (D. P. 19699) ein Filtrirgefäss, welches in zwei Zapfen hängt und leicht umgedreht werden kann. Beide Enden sind mit Siebvorrichtung versehen; zwischen beiden Sieben lagert das Klärmittel, Kohle oder dergl. Der zu filtrirende Syrup wird von unten nach oben durch die Kohle gedrückt. Ist die Kohle nicht mehr wirksam, so wird das Gefäss umgedreht. Es fliesst dann der grösste Teil des Syrups ab. Hierauf wird oben Wasser hinzugegeben, welches, als specifisch leichter, auf dem Syrup schwimmt und denselben ruhig verdrängt, ohne sich mit demselben wesentlich zu vermischen.

Gewinnung von krystallisirbarem Zucker aus Rohzucker, Zuckersäften, Syrup und Melasse. (D. P. 20595 vom 15. April 1882. A. Wernicke in Halle a./S.) Das Verfahren stützt sich auf die Eigenschaft der concentrirten Essigsäure, alle in dem Rohzucker etc. enthaltenen Nichtzuckerstoffe zu lösen, während der krystallisirbare Zucker in derselben vollständig unlöslich ist. Der Rohzucker wird zunächst getrocknet und nach Abkühlung auf eine Temperatur von unter 70° C. alsdann in einem geschlossenen und mit Rührwerk versehenen Apparat mit etwa 50 bis 70 Proc. seines Gewichtes concentrirter etwa 90proc. Essigsäure gemischt. Nach der Abkühlung nach 36 bis 48 Stunden ist fast aller Zucker in reinem Zustand auskrystallisirt, während die Mutterlauge die sämtlichen Nichtzuckerstoffe (und fast nur diese) in Lösung hält. Der Zucker wird rein abcentrifugirt. Zur Entfernung der Mutterlauge wäscht man den Zucker auf der Centrifuge mit etwas reiner Essigsäure aus und trocknet denselben nun in einem durch Dampf auf ca. 106 bis 110° C. erhitzten und mit Rührwerk versehenen, geschlossenen, eisernen Cylinder. Die entweichende Essigsäure wird gewonnen; man kann den Zucker auch durch Decken mittelst Zuckerlösung von der Mutterlauge befreien. Melasse oder Syrup wird, soweit als möglich, d. i. auf 45 bis 50° B. eingedampft und dann bei 70° mit concentrirter Essigsäure (98 bis 100proc.) versetzt. Aus der Mutterlauge wird die Essigsäure durch Destillation wiedergewonnen, und das Destillat wird durch Natriumbisulfat oder Chlorcalcium vom Wasser befreit, oder es wird das Calciumsalz dargestellt und dieses mit Schwefelsäure zersetzt. Der nach der Destillation verbleibende Rückstand kann als Dünger benutzt oder auf Methylamin, Potasche u. s. w. verarbeitet werden.

Form zum Giessen von Segment-Blöcken aus Zuckerfüllmasse, welche in der Centrifuge ausgeschleudert werden sollen. (D. P. 20238 vom 9. April 1882. R. Tschepke in Golzow.) In einem Kasten *A* werden die Formen *B* gebildet, indem man die Seitenstücke *a a'*,

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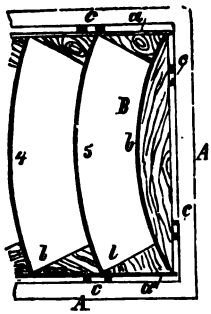
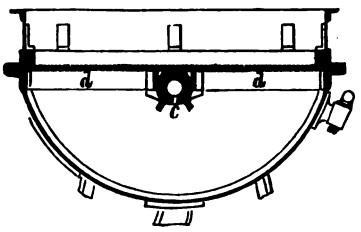
Fig. 202.



die Kopfstücke *b* und die Bleche 4, 5 einsetzt und durch Einschieben der Keile *c* befestigt. An den Seitenstücken *a a'* sind die Leisten *l* von dreieckigem Querschnitt befestigt. Figur 202.

Fig. 203.



Neuerung an Nutschapparaten. (D. P. 22615 vom 6. October 1882. Fig. 203. A. W. Mackensen in Schöningen.) Um ein Durchbiegen des Siebbleches *d* der Nutschapparate der Strontianit-Raffinerien zu vermeiden, wird das Nutschrohr *c* so angeordnet, dass es gleichzeitig als Welle und als Auflager für die Siebbleche dient. Zur Ausführung der schaukelnden Bewegung, die zum Durchwaschen des Saccharates nötig ist, dient ein Zahnsegment am unteren Teile des Apparates, in welches ein Getriebe eingreift.

Apparat zur Fabrikation von Zucker in Stücken. (D. P. 20805 vom 16. März 1882. Lebaudy frères in Paris.) Für die den Filterpressen ähnlichen Apparate zum Giessen von Zuckerstäben, welche später auf der Knipsmaschine zu Würfelzucker zerkleinert werden sollen, werden mit angegossenen oder angesetzten Rippen versehene Tafeln und Rahmen mit Dichtungsstreifen aus Kautschuk verwandt. Der Deckel des Apparates ist so eingerichtet, dass er alle Platten auf einmal abschliesst.

Bei dem Apparat zur Darstellung von Zucker in Platten, Stäben u. s. w. (D. P. 21861 vom 24. December 1881 von M. Weinrich in Wien) sind die Formen zum Giessen der Zuckerfüllmasse cubische Kästen, bei welchen der Deckel, der Boden und eine Seite, jedes für sich, entfernbar ist. Der luftdichte Verschluss wird durch eine Keilconstruction bewirkt. Zum Transport und zum Umkippen der Kästen dienen zwei an den festen Seitenwänden angebrachte Spurrollen. Die Kästen sind wie gewöhnlich mit Blechen ausgesetzt. Der Deckapparat ist so construirt, dass die Kästen lediglich durch ihr Eigengewicht luftdicht auf demselben aufsitzen. Durch eine Windevorrichtung können die Kästen während der Arbeit gehoben oder gesenkt werden.

J. Esmarch in St. Petersburg (D. P. 20197 vom 9. März 1882) trocknet den in den Formen befindlichen Zucker derartig durch Dampf, dass nur die Formen, nicht der Zucker selbst, in Berührung mit dem Dampf kommen. Nach erfolgter Erwärmung des Zuckers wird das in demselben enthaltene Wasser durch eine Luftpumpe oder dergl. entfernt. Die Luftverdünnung wird in einem besonderen Raum erzeugt, der nicht mit dem Behälter für die Zuckerformen, sondern nur mit diesen selbst in Verbindung steht. Zur Erwärmung der Zuckerformen kann auch erhitzte Luft benutzt werden.

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13. Reinigung und Verwertung der Abflusswässer.

Eine Schilderung der verschiedenen Reinigungsverfahren giebt Hahne (Artern). Die Frage der Reinigung der Fabrikwässer schwebt zur Zeit, infolge der behördlicherseits gestellten Anforderungen, über der Existenz mancher Zuckerfabriken wie eine Gewitterwolke. Die bisher bekannt gewordenen Verfahren zerfallen in zwei Gruppen: 1. solche, welche die Anwendung von Chemikalien nicht verlangen, 2. solche, welche die Anwendung von Chemikalien zur Bedingung machen. Zur ersteren Gruppe gehört:

1. Das Elsässer'sche Berieselungsverfahren: Terrassenförmig übereinanderliegende, durch Erddämme gebildete Bassins, von denen jedes das zwölfstündige Abflusswasserquantum aufnimmt, um alle zehn bis zwölf Tage aufs neue gefüllt zu werden. Innerhalb dieser Zeit sollen sämtliche organische Substanzen vergohren sein. Die Bassins sind auf ihren Wällen mit einer Grasnarbe versehen und in ungefähr 1 m Tiefe drainirt. Für 1000 Centner Rüben genügen 2 ha Land. 25 Fabriken sollen bereits derartige Anlagen haben.

2. Das Gerson'sche Versumpfungsverfahren*): Anwendung transportabler Röhren, zur Ableitung der Fabrikwässer nach einem bestimmten Turnus bald auf diese, bald auf jene in bestimmter Weise aufgepflügte Bodenfläche, so dass kleine Bassins gebildet werden, in welchen das Wasser versumpft, am besten nach vorangegangener Gährung, wie Alex. Müller solche vorschreibt.

3. Das A. Müller'sche Filtrationsverfahren: Absetzen der Schmutzwässer, dann Schaffung einer der Vergährung günstigen Temperatur, indem durch Einführung von Retourdämpfen das Wasser auf 25—40° gebracht wird. Nach erfolgter Vergährung Filtration über Kies, Kohle, Coks etc.

4. Das Röckner'sche Trennungsverfahren: Einführung der Abwässer in ein grosses verdecktes Bassin mit einem darinstehenden 8 m hohen, luftleer zu machenden und zu erhaltenden Cylinder, der das geklärte Wasser nach oben zieht, die Schmutzteile vermöge ihrer Schwere nach unten sinken lässt. Die Schmutzteile werden durch eine Schnecke oder ein Becherwerk abgeführt.

Zur zweiten Gruppe gehört:

1. Das Knauer'sche Verfahren**): Das in Bassins abgeklärte Schmutzwasser passirt ein Röhrensystem, in welchem es durch das rückfliessende gereinigte heisse Wasser vorgewärmt wird, dann wird es in einem besonderen Bassin auf 80° gebracht, erhält einen Zusatz von Kalk und nachdem es in einem tiefer gelegenen Bassin Schmutzteile niedergeschlagen hat, einen Zusatz von Manganchlorür; schliesslich wird es auf Gradirwerke gehoben.

*) Techn.-chem. Jahrb. 1883 S. 188.

**) Techn.-chem. Jahrb. 1882 S. 317, 1883 S. 268

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2. Das Bodenbender'sche Verfahren: Nach erfolgter mechanischer Reinigung durch Coks oder Reiser Anwendung von Aetzkalk in kaltem Zustande; nochmalige Filtration im Gradirwerk.

3. Das Süvern'sche Verfahren: Behandlung des Wassers mit Kalk und Teer. (Deutsche Zuckerind. 1883, 644.)

Das Elsässer'sche Verfahren wurde in der am 5. April 1883 abgehaltenen Sitzung des Zweigvereines für Rübenzucker-Industrie von Halle besprochen. Krüger (Stöbnitz) ist mit dem Verfahren zufrieden; allerdings dürfte dasselbe der erforderlichen grossen Ländereien wegen (bei einer Verarbeitung von 6—7 000 Ctr. Zuckerrüben sind 60—70 Morgen Land nötig) nicht allzu billig sein. Schulz (Querfurt) äussert Bedenken bezüglich des Heues, welches von den berieselten Wiesen gewonnen wird. Es solle von den Pferden etc. nicht gern genommen werden. (D. Zuckerind. 1883, 359.) Futterernte-Resultate des Elsässer'schen Verfahrens. In der am 17. August 1883 stattgehabten Sitzung des technischen Vereins für Zuckerfabrikanten in Magdeburg wurden nach eingegangenen Berichten der Fabriken die Ernteresultate bei Anwendung des Elsässer'schen Verfahrens mitgeteilt. Danach stellen sich die Heuerträge je nach dem Alter der Anlage zwischen 240—360 Ctr. pro Hektar = 60—90 Ctr. pro Morgen. Hierbei sei die Qualität des Zuckers eine vorzügliche. Somit machen sich die Anlagekosten des Verfahrens, auch in den ungünstigsten Fällen, in Bälde bezahlt. Es wurde hierbei ferner nachgewiesen, dass der höchste Heuertrag (90 Ctr. pro Morgen) mit der besten Wasserreinigung zusammenfällt. Es betrifft dies die Zuckerfabrik Landsberg bei Magdeburg. Bei einer täglichen Verarbeitung von circa 3 000 Ctr. Rüben werden die Abwässer auf einer Rieselanlage von 6 Hektaren Grösse gereinigt und dabei folgende Resultate erzielt (nach Analysen des Dr. Teuchert).

In 1 Liter:	schmutziges Wasser g	gereinigtes Wasser g	also verbraucht g
Gesamt-Rückstand	2·633	0·693	1·940
Glühverlust	0·483	0·051	0·432
Davon suspendirt	1·763	0·031	1·732
„ anorganisch	1·521	0·019	1·502
„ organisch	0·242	0·012	0·230
Mithin gelöste Stoffe	0·870	0·661	0·209
Glühverlust	0·241	0·038	0·203
Stickstoff als Ammoniak	0·11400	0·00084	0·01316
Proteinstoffe	0·01158	0·00252	0·00906
Salpetersäure	0·00002	0·00001	0·00001
Summa	0·02560	0·00337	0·02223

Algenbildung, Bacterien und Vibrionen wurden in gereinigtem Wasser nicht gefunden. Danach ist die organische Substanz fast ganz aufgebraucht, der kleine Rest aber im Wasser gebunden, somit nicht weiter zersetzbar.

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Ueber die Veränderungen und Wirkungen des Rieselwassers bei der Berieselung. Von J. König und C. Krauch. (Landw. Jahrbücher 1882, 158—212.) Vgl. auch den Artikel Wasser.

14. Allgemeines über Abfallstoffe.

Ueber Wert und Verwertung der Abfallstoffe in der Zuckerfabrikation hielt Paul Degener einen Vortrag im Berliner Club der Landwirte. Wenn man nach den Erfahrungen des letzten Jahres die verarbeitete Rübenmenge zu 150 Millionen Centner annnimmt, so ergiebt sich ein Wert von 65—70 Millionen Mark für sämtliche Abfallstoffe. Erst in neuerer Zeit hat die immer wachsende Concurrenz zu einer besseren Verwertung dieser Stoffe geführt.

1. Rübenblätter und Rübenköpfe betragen 20—25 Proc. vom Rübengewicht. Der Wert dieses Abfallstoffes beträgt ca. $10^1/_2$ Millionen Mark, wenn man den Preis für einen Centner zu 21 Mark berechnet. Wo man Blätter und Köpfe nicht zum Zwecke einer Frühdüngung unterpflügte, benutzte man dieselben vielfach als Futter. Indessen spricht ihr Gehalt an Oxalsäure gegen directe Verfütterung der frischen Blätter in grösseren Mengen. Man säuert jetzt Blätter und Köpfe meistens in Gruben ein, um sie einer chemischen Veränderung zu unterziehen.

2. Noch wertvoller sind die Diffusionsschnitzel, welche 80 Proc. der zur Verarbeitung gelangten Rübenmenge ausmachen. Deutschland hat in letzter Campagne 120 Millionen Centner Schnitzel erzeugt (mit 93 Proc. Wasser). Durch Pressen wird das Wasser auf 35—40 Proc. des Rübengewichtes reducirt. Nimmt man rund eine Gesamtmenge von 52 Millionen Centner gepresster Schnitzel (à Centner 30 ₰) an, so ergiebt sich hieraus ein Wert von $15^3/_4$ Millionen Mark.

3. Ammoniak. Dasselbe ist noch völlig unbenutzt. Die Gesamtmenge des auf diese Weise pro Campagne bei uns verloren gehenden Ammoniaks repräsentirt einen Wert von 8 Millionen Mark.

4. Scheideschlamm. Beträgt $7^1/_2$ Proc. vom Rübengewicht und enthält seiner Entstehung gemäss wertvolle Bestandteile (Stickstoff und Phosphorsäure). Sein Wert als Dünger beträgt $4^1/_4$ Millionen Mark pro Campagne.

5. Die Abfälle der Knochenkohlestation werden zur Superphosphatfabrikation benutzt.

6. Kali und Stickstoff der Melasse. Aus der Melasseschlempe wurde bisher meist Potasche gewonnen, wobei man aber den Stickstoff (im Wert von $6^1/_2$ Millionen pro Campagne) verlor. Erst die neueren Verfahren der Entzuckerung der Melasse haben es ermöglicht, in der Elutions- und in der Substitutionslauge neben dem Kali, dessen Wert sich pro Campagne auf 5 Millionen Mark beläuft, auch den Stickstoff in einer zum Düngen geeigneten Form zu gewinnen.

7. Die Abflusswässer, welche Stickstoff, Kali und Phosphorsäure im Werte von 8 Millionen Mark enthalten, werden zu Rieselzwecken benutzt.

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15. Die chemischen Untersuchungsmethoden.

Das Hauptinteresse auf dem analytischen Gebiete der Zuckerindustrie beansprucht augenblicklich die Alkohol-Polarisation.

Die Fehler, mit welchen die bisherige Polarisation in wässeriger Lösung behaftet ist, sind zum grossen Teil allgemein bekannt. Auf eine vor kurzem noch weniger beachtete, wenn auch schon lange bekannte Fehlerquelle macht F. Sachs (Deutsche Zuckerind. 1882, 1061) aufmerksam. Man erhält nämlich ganz andere Resultate, je nachdem man den Saft aus Rübenbrei, aus zerkleinerten oder unzerkleinerten Schnitzeln auspresst und zwar erhielt Sachs im ersteren Falle stets den meisten, im letzten stets den wenigsten Zucker. Trotzdem wurde indessen diesen Differenzen, die oft über 1 Proc. Zucker von der Rübe betrugen, nicht die nötige Beachtung geschenkt und man fuhr meist fort, den allgewohnten Saftquotienten 95 zu gebrauchen, ganz gleich auf welche Weise man den Saft erhielt. Oder man adoptirte den aus Scheibler's Untersuchungen, welche einen Saftquotienten von 90 bis 92 ergaben, resultirenden neuen Quotienten und zwar für Analysen von Rübenschnitzeln, ohne zu prüfen, ob er auch in diesem Falle anwendbar sei.

Aus Sachs' Untersuchungen geht nun zunächst hervor, dass die Saftmengen, welche mittelst einer starken Hebelpresse aus Rübenbrei (*A*), zerkleinerten Rübenschnitzeln (*B*) und unzerkleinerten Rübenschnitzeln (*C*) erhalten werden, sehr verschiedene sind. Sie betrugen bei *A* ca. 75 Proc., bei *B* 45 Proc. und bei *C* nur 33 Proc. des Gewichts der angewandten Rüben, so dass noch eine erhebliche Menge Saft im Rückstande blieb. Die Anwendung eines bestimmten Quotienten, um von dem Zuckergehalt des Rübensaftes auf den der Rübe zu schliessen, kann indess nur dann ohne Bedenken sein, wenn der ausgepresste Saft dieselbe Zusammensetzung hatte wie der im Rückstande zurückbleibende. Aus den Versuchen von Sachs geht indessen hervor, dass dies nicht der Fall ist. Sachs fand im Mittel vieler Versuche folgende Resultate:

a) Bei Rübenbrei betrug der Zuckergehalt der Rübe meist 0·94—0·95 des Zuckergehaltes des ausgepressten Saftes.

b) Bei zerkleinerten Rübenschnitzeln war der Zuckergehalt der Rübe ungefähr gleich dem Zuckergehalte des abgepressten Saftes.

c) Bei unzerkleinerten Schnitzeln war der Zuckergehalt der Rübe bedeutend grösser als der des abgepressten Saftes.

Sachs fand fast stets 4 Proc. Rohmark in der Rübe, betont aber, dass diese Zahl praktisch ohne Wert ist wegen der verschiedenen Zusammensetzung des durch Pressen erhaltenen und des im Rückstande zurückbleibenden Saftes. Man muss dagegen das Verhältnis des Zuckergehaltes in der ganzen Rübe und im abgepressten Safte kennen. Sachs schlägt für dieses Verhältnis den Namen „Saftquotient" vor.

Was nun die „Alkoholpolarisation" betrifft, so wurde diese Frage

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zunächst durch Ausschreiben einer Preisaufgabe von Seiten des Vereins für die Rübenzucker-Industrie auf die Ermittelung des Zuckers in der Rübe in Fluss gebracht. Sickel empfahl die Anwendung der Alkoholpolarisation. Hierauf nahm Scheibler ein Patent auf ein Verfahren zur Bestimmung des Zuckers der Rübe durch Kochen derselben mit 90—94grädigem Alkohol in einem Auslauge-Apparat. Nach dem Scheibler'schen Apparat folgte der Sickel-Soxhlet'sche. Ein anderes Verfahren, welches von Degener geprüft und empfohlen wurde, rührt von Rapp (Waghäusel) her. Gleichzeitig und unabhängig von Rapp arbeitete Sostmann in Minsleben eine sehr ähnliche Methode aus. Schliesslich ist noch zu erwähnen die Methode von Stammer, welche im Gegensatze zur Sostmann'schen bei gewöhnlicher Temperatur zu arbeiten gestattet. (Deutsche Zuckerind. 1883, 445.)

Methode von E. Sostmann. (Deutsche Zuckerind. 1883, 81.) 100 g Rübenbrei — gleichviel ob durch Zerreiben der Rüben oder durch Zerkleinern der Schnitzel erhalten — werden in ein Kölbchen zu 250 cbcm gefüllt, mit 80er Alkohol bis fast zur Marke bedeckt und auf ein Dampfbad zur Digestion gestellt. Nach einstündiger Digestion wird der Kolben in Wasser bis auf Zimmertemperatur abgekühlt, dann bis zur Marke mit 80er Spiritus eingestellt. Nach kräftigem Umschütteln werden 100 cbcm klar abgegossen oder abfiltrirt, mit einigen Tropfen Bleiessig und mit Wasser in 110-cbcm-Kölbchen bis zu 110 cbcm aufgefüllt und nach der Filtration polarisirt. Die abgelesenen Polarisationsgrade auf der „Tabelle mit Bleiessig" abgelesen, zeigen den Zuckergehalt der polarisirten Flüssigkeit an. Durch Multiplication mit 2·5 erhält man dann den Zuckergehalt des untersuchten Rübenbreies. Durch weitere Multiplication dieser Zahl — nach Degener's Vorschlag — mit 0·994 erhält man den durch Polarisation gefundenen Zuckergehalt der Rüben, unter der Annahme, dass 994 Tle. Flüssigkeit im Liter der untersuchten Mischung von Rübenbrei und Alkohol vorhanden waren.

2. Methode von Stammer. Da zahlreiche frühere Versuche bewiesen, dass eine möglichst weitgehende Zerkleinerung des Untersuchungsmaterials die notwendigste Vorbedingung derartiger Untersuchungen bilde, so wurde zunächst ein neues Instrument, die „Schnitzelmühle", in Anwendung gebracht. Nach mancherlei Versuchen gelang es, einen Apparat zu construiren, der geschnitzelte oder sonstwie gröblich zerkleinerte Rüben mit Leichtigkeit in einen salbenartigen, vollkommen unfühlbaren, gleichmässigen Brei verwandelt.

Die Ausführung der Untersuchung geschieht auf folgende Weise: 100 g oder mehr des obigen Breies werden auf einer Neusilberschale gewogen und mit kaltem 92proc. Alkohol in einen Kolben von 386 cbcm (oder bei grösserer Abwägung entsprechend mehr) eingespült. Da nämlich am Polarisationsinstrumente 26·048 g Zucker zu 100 cbcm gelöst 100 anzeigen, so entfällt auf 100 g Substanz, unter Berücksichtigung des Umstandes, dass das im Normalgewichte (26·048 g) Rübenbrei enthaltene Mark einen Raum von 0·6 cbcm einnimmt, um welche Grösse man am besten den Inhalt des Messgefässes direct vermehrt, ein Volumen von 386 cbcm.

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Man spült den zur Füllung dienenden Neusilbertrichter ab, verschliesst den Kolben mit einem Glasstöpsel, schüttelt kräftig um, setzt 8 cbcm Bleiessig hinzu, mischt und füllt bis zur Marke mit Alkohol auf. Nach wiederholtem starken Umschütteln lässt man eine halbe Stunde stehen und filtrirt dann durch einen mit Deckel versehenen Trichter ab; das Filtrat fängt man in einem mit Glasstöpsel versehenen Cylinder auf, schüttelt um und polarisirt in der mit Alkohol und der betreffenden Lösung gut ausgespülten 400-mm-Röhre. Lässt man das Rohr vor der Beobachtung einige Zeit ruhig liegen, um vollständigen Ausgleich von Temperatur und Dichte zu bewirken, so ist die Ablesung, vorausgesetzt, dass die Lösung vollkommen klar war, leicht und scharf vorzunehmen. Die gefundene Zahl ist zu halbiren und zeigt direct den Zuckergehalt der Rübe an.

Die beschriebene Methode bietet nach von Lippmann (Chem. Ztg.) ausserordentliche Vorzüge: sie ist leicht, ohne grossen Zeitaufwand und ohne Anwendung von Wärme auszuführen; sie gestattet, beliebig grosse Mengen Rohmaterial zur Untersuchung zu verwenden und liefert eine Flüssigkeit, die allen Saft der Rübe enthält. Das Kriterium ihrer Richtigkeit aber liegt darin, dass der im Rückstande (Marke) verbleibende Saftanteil, selbst wenn er durch einen Druck von 300 Atmosphären aus diesem ausgepresst wird, dieselbe Zusammensetzung zeigt, wie die Hauptmasse des durch kalte Auslaugung gewonnenen Saftes. Die Methode ist auf ausgelaugte Rübenschnitte ebenso anwendbar wie auf frische; sie liefert ferner wichtige Anhaltspunkte zur Entscheidung über die Frage des Saftgehaltes (Saftquotienten) der Rübe. Was die Reinheit des Rübensaftes anbelangt, so gedenkt Stammer dieselbe durch Spindelung der alkoholischen Lösung mittelst eigens construirter Alkohol-Saccharometer zu bestimmen.

Der persönliche Fehler beim Polarisiren beträgt nach P. Degener (Zeitschr. d. Ver. f. Rübenz.-Ind. 1882, 642) ± 0,15° vom Mittel der Polarisationen; also ist die absolute Differenz 0,3°.

Auf eine Fehlerquelle beim Polarisiren macht A. Hölzer (Zeitschr. d. Vereins f. Rübenz.-Ind. **32**, 955) aufmerksam. Dieselbe ist in der gelben Färbung der Zuckerlösungen begründet, kommt aber nicht bei allen Arten von Polarisationsapparaten zur Geltung (z. B. nicht beim Apparate von Laurent).

Ueber Zuckeruntersuchungen im Scheideschlamm spricht Henatsch (Magdeburg). Die Scheibler'sche Methode ist zwar die genaueste, aber ihre Ausführung beansprucht längere Zeit, so dass man bei häufigeren Schlammuntersuchungen zu schneller ausführbaren, wenn auch nicht so sicheren Methoden seine Zuflucht nehmen muss. Henatsch bringt 50 g Schlamm einer guten Durchschnittsprobe mit einem bestimmten Volumen einer gesättigten Oxalsäurelösung zusammen und verreibt die Mischung. Hierauf wird filtrirt und das Filtrat untersucht. (Deutsche Zuckerind. 1883, 10.)

Bestimmung des Zuckers im Saturationsschlamm mittelst Ammoniumnitrats. J. Ost (Sucr. belge **10**, 416) verreibt 13·024 g des

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Schlammes mit 6—7 g Nitrat, bringt in ein 100-cbcm-Kölbchen, setzt einige Tropfen basisches Bleiacetat hinzu, füllt zu 100 cbcm auf, filtrirt und polarisirt.

Ueber eine neue Methode der Schwefelcalcium-Bestimmung in der Knochenkohle mit Wasserstoffsuperoxyd. H. Schaare benutzt zu diesem Zwecke das neuerdings bekanntlich auch von Classen für eine ganze Reihe analytischer Bestimmungen empfohlene Wasserstoffsuperoxyd. Man bestimmt zuerst den in der Knochenkohle vorhandenen schwefelsauren Kalk; alsdann durchfeuchtet man etwa 25 g der fein gepulverten Knochenkohle in einem circa 300 cbcm fassenden Kölbchen mit Wasser, setzt ein Gemisch von 50 cbcm 5proc. Wasserstoffsuperoxydlösung und 100 cbcm Salzsäure hinzu und erhitzt ungefähr 15—20 Minuten bei gelindem Kochen. Nach dem Erkalten füllt man in ein $^1/_4$-Liter-Kölbchen über, füllt zur Marke auf und bestimmt in 200 cbcm des Filtrates die Schwefelsäure. Von der hier gefundenen Schwefelsäure zieht man die an Kalk gebundene und rechnet die restirende Schwefelsäure auf Schwefelcalcium um. (Zeitschr. d. Vereins f. Rübenz.-Ind. 1882, 728.)

Ueber die beste Methode bei Untersuchung von Fabrikabflusswässern giebt Degener eine ausführliche Anleitung. (Zeitschr. d. Vereins f. Rübenz.-Ind. **32**, 60.)

16. Allgemeines über Chemie der Rüben und des Rübenzuckers.

Ueber den Farbstoff der Zuckerrübe. Von F. Strohmer. (Oesterr. Zeitschr. d. Ver. f. Rübenz. 1882, 303.)

Ueber das Vorkommen von Coniferin in den verholzten Geweben der Zuckerrübe. E. von Lippmann (Ber. d. chem. Ges. **18**, S. 663) wies vor einigen Jahren nach, dass der schon seit langem beobachtete vanilleartige Geruch und Geschmack gewisser Rübenrohzucker durch einen Gehalt derselben an Vanillin verursacht wird, und fast zu gleicher Zeit hatte auch Scheibler (Ber. d. chem. Ges. **18**, 335) das Auftreten von Vanillin im Rohzucker beobachtet. Es lag nahe, das Coniferin als Quelle des in den Producten der Zuckerfabrikation auftretenden Vanillins zu betrachten, zumal schon Wiesner 1867 in seiner „Technischen Mikroskopie" darauf aufmerksam machte, dass das verholzte Gewebe der Zuckerrübe eine ähnliche Reaction zeige, wie ein mit Salzsäure befeuchteter Fichtenspan (vermöge seines Gehaltes an Coniferin) bei Berührung mit Phenol. Es gelang nun von Lippmann, das Coniferin als solches aus der Rübe abzuscheiden.

Als Rohmaterial diente eine stark verholzte, jedoch zuckerreiche, vollkommen reife Rübe, deren Zellgewebe die Reaction mit Phenol und Salzsäure in besonderer Stärke zeigte. Etwa 50 Centner dieser Rüben wurden in feinste Schnitzel geschnitten und diese Schnitte in einem kupfernen Gefässe mit Rückflusskühler partienweise so lange mit absolutem Alkohol ausgekocht, bis die alkoholische Flüssigkeit keine Polarisation mehr ergab. Ein drei- bis viermaliges, anderthalb- bis zweistündiges Kochen erwies sich zur vollständigen und sicheren Erreichung dieses Zweckes notwendig. Nachdem

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Rohrzucker aus anderen Pflanzen.

A. Aus Zuckerrohr. Betriebsresultate einer Zuckerrohrpflanzung auf Cuba. Von O. Grimmer. (Zeitschr. d. Ver. f. Rübenz.-Ind. **32**, 664.)

Auf einer Zuckerpflanzung auf Trinidad. (Deutsche Zucker-Ind. 1883, 214 und 286.)

B. Sorghum-Zucker. Während Prof. Mohr in Mobile (Pharm. Rundschau der Ver. Staaten **1**, 32) die Fortschritte betont, welche die Fabrikation von Sorghum-Zucker in der letzten Saison gemacht habe, ist L. S. Ware der Ansicht, dass keine der in Nord-Amerika angebauten Zuckerpflanzen der Runkelrübe oder dem Zuckerrohr Concurrenz machen könne. (Journal des fabricants de sucre **23**, 26.) Fr. Boeckmann.

Statistik.

Betrieb und Production der Rübenzuckerfabriken im deutschen Zollgebiet für das Campagne-Jahr 1881/82.

Campagne-Jahre bezw. Bezirke der Directivbehörden.	Zahl der im Betriebe gewesenen Fabriken.	Hiervon gewannen den Saft mittelst Diffusion	Hiervon gewannen den Saft durch Pressen, Ausschleudern, Maceriren	Menge der verarbeiteten Rüben Tonnen	Darunter von den Fabriken selbst gewonnen Tonnen	Diese Mengen wurden geerntet auf Hektar	Also von 1 Hektar Rüben 100 kg
1	2	3	4	5	6	7	8
Prov. Sachsen	136	132	4	2 774 263	1 916 409	65 287	293,5
„ Schlesien	50	48	2	917 629	159 667	6 176	258,5
„ Hannover	30	30	—	522 937	366 248	13 565	270,0
„ Brandenburg	15	9	6	156 302	63 002	2 083	302,5
Uebrig. preuss. Directivbezirke	36	35	1	681 786	87 140	3 522	247,4
Bayern, Württemberg, Baden	8	8	—	135 741	41 459	1 694	244,7
Braunschweig	30	27	3	512 148	419 807	14 615	287,2
Anhalt	31	28	3	446 623	315 618	11 733	269,0
Die anderen Directivbezirke	7	7	—	124 519	62 404	2 581	241,8

Campagne-Jahre bezw. Directivbehörden	Menge der gewonnenen Füllmasse Tonnen	Menge der gewonnenen Rohzucker aller Producte Tonnen	Menge der gewonnenen Melasse Tonnen	Aus 100 kg versteuerter Rüben wurden gewonnen: Füllmasse kg	und hieraus (Sp. 12) Rohzucker kg	und hieraus (Sp. 12) Melasse kg	Aus 100 kg Füllmasse wurden erzielt Rohzucker kg	Aus 100 kg Füllmasse wurden erzielt Melasse kg	Zur Darstellung von 1 kg Rohzucker waren an Rüben erforderlich. kg
1	9	10	11	12	13	14	15	16	17
Prov. Sachsen	347 614	275 323	59 340	12,53	9,02	2,14	79,20	17,07	10,98
„ Schlesien	103 330	74 184	28 465	11,26	8,08	3,10	71,79	27,55	12,37
„ Hannover	70 369	55 025	15 338	13,46	10,52	2,93	78,19	21,80	9,39
„ Brandenburg	18 890	13 671	4 047	12,09	8,75	2,59	72,37	21,42	11,43
Uebr. preuss. Directivbezirke	81 599	63 221	16 834	11,97	9,27	2,47	77,48	20,63	10,78
Bayern, Württemberg, Baden	16 897	11 940	4 000	12,45	8,80	2,95	70,66	23,67	11,37
Braunschweig	63 635	51 536	10 351	12,43	10,06	2,02	80,99	16,27	9,94
Anhalt	54 724	42 101	9 421	12,25	9,43	2,11	76,98	17,22	10,61
Die anderen Directivbezirke	16 946	12 721	3 017	13,61	10,22	2,42	75,07	17,80	9,79

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Im Deutschen Reich betrug, in Meter-Centnern ausgedrückt, die

Waarengattung	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an Zucker	44 888	46 337	3 488 237	4 547 555
„ Stärke	18 051	17 857	140 962	84 585

XXII. Stärke und Stärkezucker.

A. Stärke.

I. Rohmaterial.

Nach Bieler (Machern) geben mit Chilisalpeter gedüngte Kartoffeln mehr Schlamm, in Gründen gewachsene grauere Stärke. Der Reifegrad der Kartoffeln ist von grossem Einfluss auf den Glanz und die Festigkeit des Fabrikates (Zeitschr. f. Spiritusind. 1883 484).

Untersuchungen über die Verteilung grosser und kleiner Stärkekörner in verschiedenen Kartoffelarten und ihren Einfluss auf die Ausbeute in Stärkefabriken stellte O. Saare an. Die befolgte Untersuchungsmethode schloss sich der des Hefezählens an, d. h. es wurden alle auf einer gewissen Fläche unter dem Mikroskop sichtbaren Stärkekörner eines Durchschnitts-Präparates gemessen und daraus der mittlere Durchmesser der Stärkekörner einer bestimmten Stärkesorte festgestellt. So fanden sich als mittlere Durchmesser der Producte der Stärkefabrik von Hennig & Gräger in Genthin:

für Primastärke (direct aus Kartoffeln)	33	Mikromillim.
für Secundastärke (erste Schlammverarbeitung)	21	„
für Tertiastärke (zweite „)	17	„
von der letzten Flute abfliessende Stärke	12·5	„
von den Aussenbassins auf die Wiese abfliessende Stärke	8	„

Als Grenzwerte für die Beurtheilung der Grössenverhältnisse der Stärkekörner in Kartoffeln wurden darauf hin angenommen: Mehr wie 21 Mikromm: Primakörner, 21—12·5: Secundakörner, weniger als 12·5: Verlustkörner. Die aus verschiedenen Kartoffelsorten ausgewaschene Stärke wurde unter dem Mikroskop Messungen unterworfen und so festgestellt, wieviel Prima-, Secunda- und Verlustkörner in jeder Kartoffelsorte vorhanden waren. Unter der Annahme, dass die Körner Kugeln seien, wurde aus dem mittleren Durchmesser der drei Arten von Stärkekörnern und dem spec. Gewicht absolut trockener Stärke = 1·633 das Gewicht der Anzahl der drei Stärkekörnerarten in den verschiedenen Kartoffelsorten, Seed, Daber (2), Champion und Redskin flourbal, festgestellt und gefunden, dass bei Daber sowohl die Secunda- wie die Verlustkörner gegenüber Seed und den beiden anderen

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Sorten vorwiegen, dass jedoch der dadurch bedingte Verlust für die Stärkefabrikation ein immerhin geringer ist. Der Widerspruch dieses Resultates mit der Praxis, welche die Daber'sche Kartoffel entschieden bevorzugt, löst sich dadurch, dass 1 Proc. Mehrgehalt an Stärke in der Daber'schen Kartoffel genügt, um trotz grösseren Verlustes eine grössere Stärkemenge als bei Seed zu erzielen; und 1 Proc. Differenz im Stärkegehalt kann mittelst der spec. Gewichtsbestimmung nicht sicher erkannt werden.

Aus den Versuchen resultirt ferner, dass wahrscheinlich die Qualität der Stärke von der Grösse der Körner beeinflusst wird. Zeigte doch die bekannte Marke der Küstriner Fabrik B. K. M. F. den mittleren Durchmesser von 35·5 Mikromillim. gegenüber 32·8 der Genthiner Waare. (Zeitschr. f. Spiritusind. 1883, 482.)

2. Apparate zur Stärkefabrikation.

Auf Waschmaschinen für Kartoffeln etc. sind folgende Patente genommen: No. 16 373 und 17 470 von F. W. Hering in Osterfeld, Kreis Weissenfels; No. 21 792 vom 30. August 1882 von Justus Zinkeisen; No. 21 889 vom 22. August 1882 von J. Heyne, Stettin; No. 22 332 vom 24. October 1882 von Gebr. Boehmer, Neustadt-Magdeburg.

Zerkleinerung der Kartoffeln. Das D. P. 21 786 erhielt Gottfried auf eine Kartoffelreibemaschine zur Gewinnung von Kartoffelmehl. Als Einsatz für Reiben empfiehlt Günther (Neustadt i./Meckl.) Sägeblätter mit 20 Zähnen von 1·5 mm Höhe auf den rheinischen Zoll, als Nachzerkleinerungsapparat einen Mahlgang aus einem Granit- und einem Sandstein. (Zeitschr. f. Spiritusind. 1883, 543.)

Der Kartoffelstärke-Apparat von W. Angele in Berlin, D. P. 16 221 vom 14. November 1881, stellt eine Vereinigung sämtlicher bei der Kartoffelstärke-Fabrikation in Anwendung kommender Hauptmaschinen zu einem, von einem gemeinschaftlichen Gestell gehaltenen Apparat dar, zum Zweck, die einzelnen Maschinen durch einen einzigen Riemen in Betrieb setzen zu können.

Die Kartoffeln werden in die Wäsche c gebracht, von welcher sie durch schraubenförmig gestellte Steinschneider über die Rinne v in die Reibe d gelangen. Diese erhält durch β fortwährend Wasser. Der Brei gelangt dann in das Bassin e, aus dem er durch die Pumpe f nach dem Sieb g befördert wird. Dies Sieb erhält durch eine Vorlegewelle mit konischen Rädern eine Schüttelbewegung, zur Abscheidung der losen Stärke. Die Milch läuft durch z nach der Milchmulde η des Auswasch-Apparats i. Der Brei gleitet über das Sieb und bei ϑ auf die Breimühle h, welche eng und weit gestellt werden kann. Durch die Spirale k des Auswasch-Apparates gleitet der Brei bis λ. Die Stärkemilch läuft durch die Siebtrommel nach der Milchmulde η. Die Pülpe verlässt den Auswasch-Apparat durch die Oeffnungen π und fällt in das Bassin o. Die Milch von der Milchmulde fliesst auf das Raffinirsieb k^1, welches ebenfalls eine Schüttelbewegung erhält. Die nun raffinirte Milch

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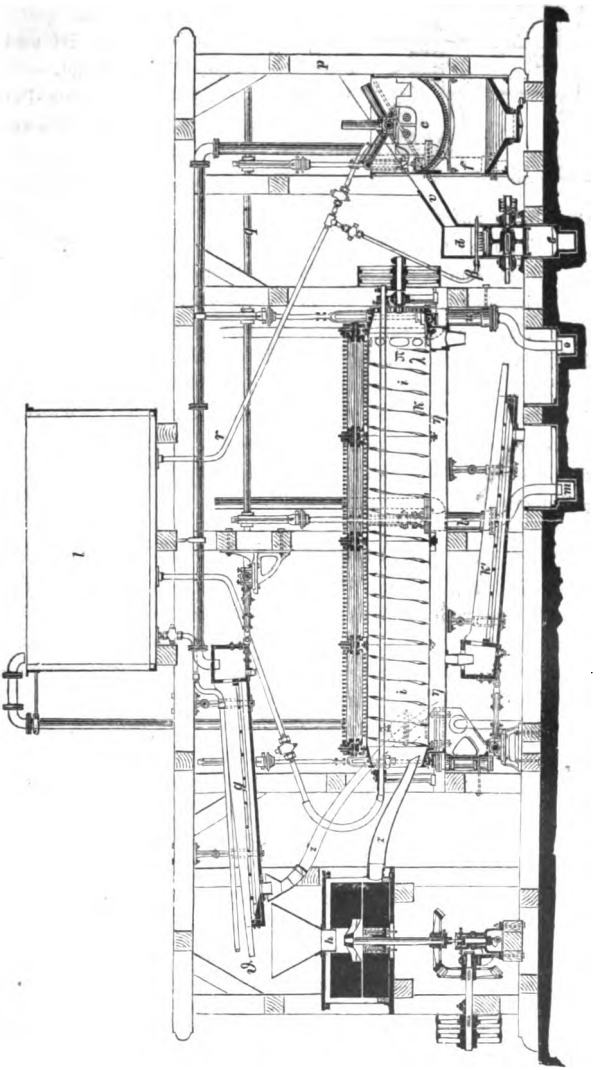
fliesst in das Milchbassin *m* und die unreine Schlammmasse nach dem Pülpebassin *o*. Aus dem Milchbassin *m* wird die Milch durch Pumpe *b* nach dem Absetzbassin befördert, während die Pülpe aus *o* durch Pumpe *u* nach dem Pülpebehälter geschafft wird. Das zur Fabrikation nötige Wasser wird nach Reservoir *l* gepumpt, von welchem dasselbe nach den verschiedenen Maschinen mittelst Rohrleitungen verteilt wird. Sämtliche Maschinen werden durch zwei Transmissionswellen *q* getrieben.

Fig. 204.



Centrifugen. C. Rudolph & Co. in Neustadt-Magdeburg stellen in der Centrifuge trockene Stärkeblöcke von bestimter Form her. (D. P. 18712 v. 18. Nov. 1881, Fig. 205.) Die Welle *a* trägt acht radiale Gabeln *i*, in denen die Kästen *E* hängen. Diese sind oben etwas weiter als unten und haben einen durchlochten Boden, auf dem ein feines Drahtsieb und darüber eine Lage Tuch liegt. Die Centrifuge ist von dem Mantel *A* umgeben. Die

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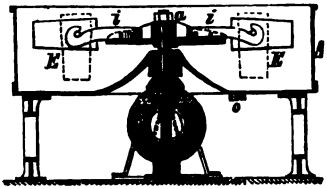
Fig. 205.



Kästen *E* werden mit Stärkemilch gefüllt und dann so lange geschleudert, bis alles Wasser verdrängt ist und die Stärke einen festen Würfel bildet.

Nach dem Zus.-Pat. 19593 ist der Boden des Einsatzkastens lose und mit einem Gummiring abgedichtet. Der Einsatzdeckel ist zur Herstellung einer glatten Oberfläche auf dem Stärkeblock der Form des Kastens entsprechend.

Trockenvorrichtung. Einen Apparat zur besseren Ausnutzung des Retourdampfes in den Dampfkammern von Trockenapparaten liess sich Rodl in Radotin durch D. P. 21865 vom 11. August 1882 sichern.

Um Wasser für die Stärkefabrikation zu filtriren, wird nach dem D. P. 19754 vom 25. Nov. 1881 von Flessbach in Kurow bei Zelasen dasselbe zunächst durch Klärbassins geleitet, welche cylindrisch sind und in die mit Knochenkohle gefüllte durchlöcherte Holzkästen eingestellt sind. Hierauf fliesst es durch ein gemauertes Bassin, welches Querscheidewände hat, die abwechselnd oben und unten dem Wasser Durchgang gestatten. Die Abteilungen sind mit Kohle gefüllt.

3. Verluste bei der Stärkefabrikation.

Von Einfluss auf das Absetzen der Stärke hält Kette (Jassen) die Menge von in Wasser löslichen und suspendirt bleibenden Trockensubstanz-Bestandteilen der Kartoffel, welche nicht Stärke sind, und welche in Kartoffeln von verschiedenem Stärkegehalt variiren, so zwar, dass stärkearme Kartoffeln mehr davon enthalten müssen, weil bei ihnen der grösste Verlust durch Nichtabsetzen gefunden wurde. (Zeitschr. f. Spiritusind. 1883, 485.)

Um die Grösse des Verlustes bei der Stärkefabrikation festzustellen, untersuchte Saare die Kartoffeln, die Pülpe und die gewonnene Stärke von zwei Kartoffelsorten, Daber und Seed. Die Kartoffeln hatten nach der Wäsche eine Reibe, ein Bürstensieb, eine Excelsiormühle, ein Cylindersieb, einen Mahlgang und wieder ein Cylindersieb zu passiren. Der Schlamm wurde auf Schlammrinnen mit sehr geringem Fall gereinigt. Der Verlust an Stärke, welche in der Pülpe zurückbleibt, ist bei weitem der grössere gegenüber dem, welcher beim Schlämmen durch Wegschwimmen der kleinsten Stärkekörner eintritt. Bei der Daberkartoffel erwies er sich als etwas höher in der Pülpe als bei Seed. Es kann das seinen Grund darin haben, dass die Zellen der Daber'schen Kartoffeln sich unter dem Mikroskop als durchschnittlich kleiner ewiesen, wie bei Seed, sich also der Zerreissung auf der Reibe leichter entziehen. Die zurückbleibende Pülpe enthielt in absoluter Trockensubstanz noch immer über die Hälfte an Stärke. Auch beim Schlämmverlust zeigte sich die Daber'sche Kartoffel als minderwertig (siehe auch oben Verteilung grosser und kleiner Stärkekörner), da aber diese Zahlen aus der Differenz des in der Pülpe und an grüner

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Stärke gefundenen gegen den in der Kartoffel festgestellten Stärkegehalt gewonnen wurden, so sind sie nicht absolut zuverlässig. Durch die Wägung der Mengen grüner Prima- und Schlammstärke fand sich eine höhere Ausbeute an Primastärke bei Daber, besonders bei einer Sorte Daber, welche faule und erfrorene Kartoffeln enthielt. Der aus dem Gewinn gegen die zur Verarbeitung gelangte Stärke berechnete Gesamtverlust ergab sich nicht über 21 Proc., und sank bei einer Sorte bis auf 13 Proc., während nach älteren Versuchen 25 Proc. anzunehmen sind. (Zeitschr. f. Spiritusind. 1883, 174.)

4. Verwertung der Rückstände der Stärkefabrikation.

Günther in Neustadt in Mecklenburg hat im kleinen Pülpekuchen und Pülpemehl hergestellt, dieselben enthalten 5·25—0·04 Proc. Protein. (Zeitschr. f. Spiritusind. 1883, 523 u. 529.)

Die in den Abwässern der Stärkefabriken gelösten Eiweissstoffe gewinnt Kette (Jassen), indem er zu dem Abwasser in dünnem Stral eine schwefelsaure Lösung von Gummi (?) fliessen lässt, nach dem Absitzen abhebert, durch Dämpfen in Holzbottigen zum Zusammenballen bringt und wieder abhebert. Der Niederschlag wird mit Soda neutralisirt und mit der Pülpe gemischt verfüttert. (Zeitschr. f. Spiritusind. 1883, 523.)

Ueber die bessere Verwertung der Abfälle der Stärkefabrikation hielt Maercker einen Vortrag, in dem er besonders das Verfüttern erwärmter Pülpe für die „Bekömmlichkeit" des ohnehin wegen seiner Stickstoffarmut geringwertigen Futtermittels empfiehlt und auf die grossen Verluste, welche dem Boden durch die in den Abwässern fortfliessenden Stickstoff-, Kali- und Phosphorsäuremengen erwachsen, hinweist. Die einzige mögliche Verwertung der letzteren sieht Verf. in der Berieselung. Zur Zeit würden aber zu kleine Flächen dazu benutzt und dadurch übersättigt. Als System scheint ihm das Gerson'sche als empfehlenswertestes. (l. c. 501).

5. Theoretisches.

Ueber Stärkebildung aus Zucker. Beim Eintauchen von entstärkten oder vergeilten Blättern, Stiel- und Stengelstücken von *Phaseolus multiflorus* in Zuckerlösungen (Rohr- oder Stärkezucker) fand J. Böhm schon nach 24 Stunden Stärke, deren Menge von der Concentration der Zuckerlösung abhängig ist. Daraus schliesst derselbe, dass die Stärke sich in der Pflanze aus Zucker bildet und dieser als erstes Assimilationsproduct der Pflanze anzusehen ist. (Zeitschr. f. d. gesamte Brauwesen 1883, 76.)

Die Elementarzusammensetzung der Reisstärke suchte Salomon in derselben Weise festzustellen, wie er dies für Kartoffelstärke gethan hatte.*) Die Menge der beim Kochen mit verdünnten Säuren entstehenden Producte war, wie bei Kartoffelstärke gleich 111·11. Die ermittelte Ablenkung im Scheibler'schen Apparate betrug 34·0° also $\alpha j = 58{\cdot}76$

*) Techn.-chem. Jahrb. 1883, S. 156.

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und danach die Dextrosemenge 111·12. Dagegen fand Verfasser bei der Reductionsmethode nach Allihn nur 106·95 Dextrose, statt 111·11. Verfasser glaubt daher annehmen zu müssen, dass die fabrikative Behandlung der Reisstärke mit Laugen eine Veränderung derselben hervorruft, welche zur Folge hat, dass beim Behandeln mit Säuren ausser Zucker noch andere nicht reducirende Körper gebildet werden. (Journ. prakt. Chem. 1882, **26**, 324.)

Die Quellungstemperaturen der Stärkekörner verschiedener Pflanzen stellte W. H. Symons durch mikroskopische Beobachtung und mittelst eines Thermometers fest, welches die Temperatur des mikroskopischen Objectes festzustellen geeignet war, Die grössten Stärkekörner zeigten die niedrigste, die kleinsten die höchste Quellungstemperatur. Erhält man Stärkekörner längere Zeit bei einer etwas unter der Quellungsgrenze liegenden Temperatur, so quellen sie nachher erst bei etwas höherer Temperatur wie gewöhnlich. Bei allmäligem Erhitzen geht die Verkleisterung von innen nach aussen, das Stärkekorn platzt schliesslich, der Kleister fliesst aus, die Hülle bleibt aber in Form und Grösse des ursprünglichen Kornes zurück. (Zeitschr. f. d. ges. Brauw. 1883, No. 6, nach The Brewers Guardian No. 323.)

Eine Unterscheidung der verschiedenen Stärkearten mittelst des Quellungsverfahrens versuchte derselbe Verfasser, da die Bestimmung der Temperaturen Schwierigkeiten bietet, mit Natronlauge verschiedener Concentration (0·5—1·5 Proc.) und fand, dass mit dem Abnehmen der Korngrösse die zur Herbeiführung der Quellung erforderliche Menge Natron steigt. Es werden 0·1 g Stärke mit 1 cbcm der verschiedenen starken Lösungen geschüttelt und nach 10 Minuten unter dem Mikroskop geprüft. (Archiv der Pharmacie 1883, 73.)

B. Stärkezucker.

I. Stärkezuckerfabrikation mit Malz.

A. P. Dubrunfaut in Paris, fabricirt nach E. P. 1048 vom 11. März 1881 Maltose, indem ein Teig aus Stärke und warmem Wasser mit einem Malzaufguss vermischt wird. Die Mischung wird auf hoher Temperatur erhalten bis alles Dextrin in Maltose umgewandelt ist. Die sich ergebende Flüssigkeit wird geklärt, filtrirt und im Vacuum eingedampft.

P. Leplay und An. Cusinier in Paris (D. P. 19125 vom 27. März 1881) nehmen im Malz zwei verschiedene Fermente an, die „Dextrinase", welche Stärkemehl in Dextrin umwandelt und die „Maltase", welche Dextrin in Zucker (Maltose) umwandelt. Um reine krystallisirte Maltose oder reinen Maltosesyrup herzustellen, soll die Malzmenge 40—50 pCt. des angewendeten Stärkemehles betragen und das Einmaischen in dem 15—20fachen Gewicht Wasser bei 70° erfolgen. Durch ein Osmoseverfahren kann dann die Maltose von nicht krystallisirbaren Stoffen getrennt werden. Oder besser verfährt man so, dass das Stärkemehl mit dem 13—20fachen Gewicht Wasser auf 70° er-

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wärmt wird und dann mit einem Malzaufguss, welcher 25—30 Proc. des Gewichtes der angewendeten Stärke an Malzmehl enthält, vermischt wird. Die Temperatur der Mischung soll nicht über 50° gehen. Die Umwandlung in Maltose wird dann vollständig, eine Osmose ist nicht nötig, die Lösung kann gleich eingedampft werden.

2. Stärkezuckerfabrikation mit Säuren.

Eine Erfindung von Aug. Ch. Dom. Poehez in St. Amand les Eaux (E. P. 4514 vom 4. November 1880) bezieht sich auf die Umwandlung in Dextrin und weiter in Glucose von Pflanzenüberresten im Dünger von Pflanzenfressern. Der Dünger wird zunächst unter Druck mit Kalkmilch behandelt. Nach darauf folgendem Waschen mit Säure und Wasser werden Pectate und andere Stoffe durch Auslaugen in Aetzkalilauge entfernt. Die nun fast reine Cellulose wird zur Umwandlung in Dextrin u. s. w. mit Schwefelsäure behandelt, nach bekanntem Verfahren.

3. Raffination von Stärkezucker.

Nach Arno Behr in Jersey City, V. S. A. (D. P. 21401 vom 18. April 1882) wird eine Lösung von Traubenzucker, welche nur etwa 13 Proc. Wasser enthält, auf einer Temperatur von ungefähr 30° erhalten, bis die dann erfolgende Krystallisation des wasserfreien Traubenzuckers vollendet ist. Dieselbe beansprucht um so mehr Zeit, je unreiner der Zucker ist und wird bedeutend beschleunigt durch Zumischung einer minimalen Menge krystallisirten wasserfreien Traubenzuckers. Bei einer Lösung z. B., welche in 100 Tln. Trockensubstanz 92 Tle. reinen Traubenzucker enthält, genügte $^1/_{500000}$ bis $^1/_{300000}$ eines gröberen Pulvers der Krystalle. Die Krystallisation dauert dann etwa eine Woche und liefert Krystalle von der für die Centrifuge notwendigen Grösse. Ein stärkerer Zusatz von Krystallen oder fortgesetztes Rühren bewirken eine feinere Krystallisation. Die Gegenwart von krystallisirtem Traubenzuckerhydrat beeinträchtigt die erfolgreiche Ausführung des Verfahrens. Die krystallisirten Zuckermassen werden durch ein Brechwerk oder eine Schneidemaschine zu einer halbflüssigen Masse zerkleinert, und da der den Krystallen anhaftende Syrup sonst leicht trübe und steif wird, unmittelbar darauf wie Rohrzuckerfüllmasse centrifugirt und, wenn nötig, ausgedeckt. Das Verfahren findet sowol auf fertigen käuflichen Traubenzucker als auch auf Lösungen, welche durch Umwandlung von Stärke erhalten wurden, Anwendung.

Ludwig Vieneisel in Miltenberg am Main stellt Stärkezuckerhydrat her (D. P. 21749 vom 16. August 1882), indem der durch Krystallisiren einer 25- bis 35-gradigen Stärkezuckerlösung von einem Reinheitsquotienten von nicht unter 95 gewonnene Krystallbrei mit Dünnsaft angemaischt, dann abgenutscht und mehrmals mit farblosem kalten Dünnsaft gedeckt wird.

J. M. Cameron und H. J. Anderson in London mischen die eingedickte Traubenzuckerlösung mit Stärkemehl. Die Masse wird zerkleinert und durch

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Siebe verteilt. Die wasserentziehende Substanz soll von den Körnern durch wiederholtes Sieben und Anwendung eines Luftgebläses zum grössten Teil wieder getrennt werden. (Engl. P. 2725 vom 9. Juni 1882.)

Wilhelm in Buffalo (Engl. P. 1208 vom 13. März 1882) will, um dem Traubenzucker die Klebrigkeit zu nehmen, die eingedampfte Lösung in den Kühlgefässen mit 3 Teilen granulirtem Rohrzucker versetzen.

4. Verwertung der Rückstände.

Alex. Manbré in Liverpool digerirt nach dem Engl. P. 3996 vom 4. October 1879 die nach der Gewinnung der Stärke bleibenden Maisrückstände mit verdünnter Schwefelsäure, bis alle noch vorhandene Stärke in Glucose umgewandelt ist. Die Lösung wird der Gährung überlassen. Die Rückstände werden durch Dämpfen aufgeweicht und zur Gewinnung von Oel einem starken hydraulischen Druck ausgesetzt.

5. Untersuchung von Stärkezucker.

H. W. Wiley (Lafayette, Indiana) bestimmte den Gehalt von 7 amerikanischen Stärkezuckerproben an Dextrose, Maltose und Dextrin, Asche und Wasser. Um die drei organischen Verbindungen analytisch trennen und berechnen zu können, bediente sich Verf. einer besonderen Methode. Er bestimmte die directe Reductionsfähigkeit der Stärkezuckerlösung auf Kupferlösung, die Polarisationsgrösse derselben Lösung und der Lösung nach dem Behandeln mit Qnecksilbercyanid, worauf sie nur noch Dextrin enthalten soll. Aus den so gewonnenen drei Daten berechnet Wiley die Dextrose, Maltose und das Dextrin, giebt aber selbst zu, dass die Methode nur richtig ist, wenn die bei der Zersetzung mit Quecksilbercyanid entstehenden Producte als optisch unwirksam angenommen werden. (Zeitschrift f. landw. u. techn. Fortschritt d. landw. Gewerbe von Kohlrausch 1883, 66.)

Vergleichende Zuckerbestimmungen nach der Fehling'schen, Sachsse'schen und polarimetrischen Methode in Stärkezucker- und Stärkesyrupproben ergaben B. Haas, dass die Polarisation allein immer zu hohe, ganz unbrauchbare Zahlen giebt, dass die Resultate der Fehling'schen und Sachsse'schen Methode nur bisweilen übereinstimmen, dass jedoch nur die erstere dieser beiden Methoden anwendbar sei, da die alkalische Quecksilberlösung offenbar auch noch durch andere Substanzen als durch Zucker reducirt wird (z. B. durch Alkohol und Glycerin). (Zeitschr. f. analyt. Ch. 1883, 215.)

Tollens fand, dass das Verhalten der Dextrose zu ammoniakalischer Silberlösung ein anderes sei, als nach dem gegen alkalische Kupferlösung zu schliessen war, indem bei ersterer mehr Metall reducirt oder Sauerstoff aufgenommen wird, als bei letzterer. Verf. knüpft hieran Betrachtungen über die Constitution von Dextrose und Lävulose. (N. Zeitschr. f. Rübenzuckerind. 1883 No. 21.)

O. Saare.

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Statistik.

Uebersicht über die Production von Stärkezucker im Deutschen Zollgebiet in dem Etatsjahr 1881—1882.

Staaten und Verwaltungsbezirke.	Zahl der Stärkezuckerfabriken.	Menge der zu Stärkezucker verarbeiteten Stärke.				Menge des gewonnenen Stärkezuckers.			Durchschnittl. Verkaufspreis pro 100 kg.		
		Selbstfabricirte Stärke		Angekaufte Stärke		Stärkezucker in fester Form.	Stärkezucker-Syrup	Ausserdem Couleur	Stärkezucker in fester Form	Stärkezucker-Syrup	Couleur.
		nasse	trockene	nasse	trockene						
		100 kg	100 kg	100 kg	100 kg	100 kg	100 kg	100 kg	ℳ	ℳ	ℳ
Preussen:											
Prov. Brandenburg .	15	170 647	18 500	295 670	100	134 269	132 347	7 508	27.7	28.4	37.0
„ Pommern . . .	4 [1]	1 715	—	1 180	—	1 500	243	—	24.0	30.0	—
„ Posen	1	3 000	—	15 557	—	1 792	7 256	2 175	24.0	26.0	26.0
„ Schlesien . . .	4	8 525	—	75 000	—	14 100	3 350	2 600	23.8	24.2	39.8
„ Sachsen	4	20 518	2 037	9 835	—	7	13 287	3 117	30.0	27.5	35.1
„ Rheinland . . .	2	12 000	—	—	—	8 000	—	—	32.0	—	—
Summa . .	30	216 405	20 537	397 242	100	159 668	156 483	15 400	27.6	28.2	35.5
Bayern	1	—	—	—	—	350	—	—	30.0	—	—
Baden	1	—	—	—	—	—	—	—	—	—	—
Hessen	3 [1]	4 750	30	—	400	4 150	—	—	29.0	—	—
Mecklenburg	1	7 750	—	—	—	—	4 800	—	—	24.0	—
Braunschweig	1	4 500	—	—	1 275	—	3 000	—	—	21.0	—
Elsass-Lothringen . .	2	8 422	—	2 983	—	3 082	4 752	—	30.0	36.0	—
Zollgebiet 1881/82	39 [2]	241 827	20 567	400 225	1 775	167 250	169 035	15 400	27.6	28.1	35.5
Dagegen im Etatsjahr 1880/81	45 [2]	196 761	8 200	258 121	3 254	105 916	161 720	7 693	33.0	32.0	36.6

[1] Darunter 2 ausser Betrieb.

[2] Darunter 1881/82 4, 1880/81 7 ausser Betrieb.

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Anhang: Stärke- und Traubenzucker-Industrie in den Vereinigten Staaten.

A. Stärke.

Nach W. Jebb's Vorschlag (V. St. P. 263525) soll der grobe Abfall, welcher als Nebenproduct bei der Stärkefabrikation aus Mais gewonnen wird, vom Wasser durch Quetschen und Trocknen befreit werden, um ihn vor Säurung zu bewahren. Das trockne Präparat wird mit Maismehl gemischt.

S. Renwick (V. St. P. 263958) sucht die feinsten Mahlproducte, welche nach dem Entstärken in den Abfallwässern verbleiben, als Viehfutter zu gewinnen. Zu dem Zwecke filtrirt er die dünne Masse durch die groben Abfälle und trocknet nachher die Mischung. Die groben ausgepressten Abfälle werden auf den Siebboden eines geschlossenen eisernen Cylinders gebracht und dann die dünnen Abfälle mittelst einer Röhre in die grobe Masse gepresst. Um ein Verstopfen am Ausflussende dieser Röhre zu verhüten, hat der Erfinder die letztere unten mit Schälmessern versehen, welche beim Betrieb immer frische Filterflächen erzeugen.

W. Duryea (V. St. P. 263030) hat sich eine Zuflussregulirung der Stärketische patentiren lassen und glaubt durch genügend langsames Ablaufenlassen alle Stärke zum Absetzen zu bringen. Zwischen die Stärketische und dem Stärkemilchbehälter ist eine Rinne eingeschaltet, welche mit Hilfe eines Schwimmers stets gleich voll gehalten wird. Von dieser Rinne aus regulirt man die Speisung der Stärketische. Rührwerke verhindern das Absetzen der Stärke in den Bottichen und in der Rinne.

Zum Aufrühren abgesetzter Stärke haben D. & F. Firmenich (V. St. P. 260380) eine automatisch wirkende Vorrichtung construirt. Bei den bisherigen derartigen Einrichtungen wurde das Rührwerk mit der Hand auf die verhältnismässig feste Stärke herabgelassen und geschah solches zu rasch, so zerbrach oft die Maschinerie. Das neue Rührwerk kann mittelst Zahnrad und Zahnstange leicht auf- und abbewegt werden.

P. Grimm (V. St. P. 261445, 264688, 266136) hat drei Neuerungen an Stärkesieben eingeführt. Die Erfindung bezieht sich auf die Stärkesiebe mit hin- und hergleitender Stossbewegung. Wie bekannt ruhen diese Siebe nach den jetzigen Constructionen am oberen Ende auf Armen und haben nur am unteren Ende Gleitflächen. Erfinder ersetzt die Schwingung des Siebes durch Arme teils durch Doppelgelenke, teils durch Gleitflächen. Durch Concavität und Convexität derselben befördert er noch das Auf- und Abwärtsbewegen des Siebes.

G. Graves (V. St. P. 270304) hat sein früheres Patent (G. Graves & D. Heede 256315) verbessert. Damals hatten beide Erfinder Querrinnen an den Stärkesieben angebracht, welche das Auswaschen der Stärke aus dem Brei erleichtern sollten. Die Rinnen wurden durch Röhren mit Wasser gefüllt gehalten und so das Brei stets von neuem aufgeschlämmt. Graves hat nun das successive Auswaschen und die damit verbundene Wasserersparnis noch

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weiter ausgebeutet und will die Stärkewasser verschiedener Dichten gesondert auffangen. Sein Sieb ist durch vier Rinnen in fünf Abschnitte geteilt und diese sind je einzeln mit einem Trichter unterhalb versehen, welcher die filtrirte Stärkemilch in die gewünschten Tröge trennt.

J. Duff strebt danach, die Stärketische entbehrlich zu machen (V. St. P. 270210). Nach der heutigen meist gebräuchlichen Methode weicht man den Mais in warmem Wasser und zermalmt ihn nachher zwischen Mühlsteinen. Der mit Wasser aufgeschlämmte Brei wird auf Schüttelsiebe geleitet und die Stärke ausgewaschen. Die Stärkemilch lässt man mehrere Stunden stehen, bis sich alles abgesetzt hat und zieht das Wasser vorsichtig ab. Der Bodensatz wird von neuem aufgerührt und mit verdünnter Natronlauge behandelt, welche sowohl die Eiweissstoffe auflöst, als auch das Fett in Suspension bringt. Ist dieses geschehen, so verdünnt man noch weiter und lässt alles über die Stärketische laufen. Hier setzt sich die Stärke ab, während alle Beimengungen vom Wasser fortgeschlämmt werden. Aber das Absetzen der Stärke geschieht bei weitem nicht vollständig. Zur Reinigung schlämmt man nochmals mit Wasser auf. Duff ändert diese Methode nun wie folgt ab, sich als Problem setzend, alle Cellulose nicht wie bisher fortzuschaffen, sondern mit der Stärke zu gewinnen und nachher zu convertiren. Zunächst lässt er sehr grob mahlen und durch grobe Siebe trennen, um Hülle und Keim möglichst ganz zu gewinnen. Das Durchgewaschene sammelt man in Bottichen unter stetem Umrühren, und sobald je ein Bottich voll gelaufen, lässt man nur das Grobe absetzen und zieht sogleich die Stärkemilch ab. Der Absatz wandert zurück zur Mühle und wird von neuem übergemahlen. Man erhält so schliesslich zwei Producte, einen groben Abfall und eine Stärkemilch. Letztere lässt man völlig absetzen und entfernt mit Natronlauge Alluminate und Fett. Merkwürdig, dass der Erfinder die Holzfaser der Schale gar nicht berücksichtigt, sondern nur die Holzfaser des Kerns, sonst wäre er bald wieder beim „dry process"-Verfahren angelangt. Nach Duff's zweitem Patent (270894) befeuchtet man den Mais nur oberflächlich und mahlt direct die Hülsen herunter. Das trockne Mehl wird dann vom Rest der Hülsen durch Abblasen getrennt und als solches convertirt. Die Patenturkunde ist voll ungenauer Angaben und technischer Unmöglichkeiten.

Jebb (V St. P. 270439) hat es für nötig gehalten, die Anwendung der Filterpressen für die Gewinnung der Stärkeabfälle aus allen Fabrikationswässern zu patentiren. Ob sich für manche nur die Kosten des Pumpens bezahlen, möchte schon sehr fraglich sein. Auch hat er ganz vergessen, seine Zellenabfälle vor dem Filtriren zu neutralisiren, sonst wird der Hauptbestandteil gewiss nicht Gluten sein.

F. Renwick (V. St. P. 272324) scheint bei seinem Patent (263958) auf Schwierigkeiten in der Filtration der feinen Abfälle durch die groben gestossen zu sein. Nach dem neuen Patent soll der grobe Abfall mit dem feinen gemischt und dann auf endlosen Sieben in dünner Schicht filtrirt werden. Seine Maschine ist ähnlich der in der Papierfabrikation bekannten

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Fourdrinier'schen. Das fertige Gemisch der beiden Abfälle soll schliesslich gepresst und gebacken werden.

T. Müller und J. Decastro (V. St. P. 273127 und 128) centrifugiren die Stärkemilch, um eine continuirliche Trennung in Stärke und Zellenreste zu erzielen. Durch die Centrifugalkraft wird die Stärke an die Aussenwand geschleudert, während das Wasser mit der Nicht-Stärke abgeschält wird.

F. Matthiessen (V. St. P. 273572) regulirt den Ab- und Zulauf der Stärkemilch auf den Tischen mit Uhrwerk.

W. Allen (V. St. P. 285318) stellt seine Stärketische auf keilförmige Unterlagen, um so jederzeit völlige Ebenheit der Tische zu bewahren. W. Allen's (275319) Stärkewaschmaschine ist ein in Kammern mit durchlöcherten Wänden geteilter Cylinder, in welchem der Inhalt durch starkes Rührwerk kräftig gemischt werden kann. W. Allen (275320) scheint seinen Collegen zuzumuten, dass sie ihr Siebzeug ohne unterstützende Leisten aufspannen; er glaubt daher diese Neuigkeit patentiren zu müssen.

F. Kimball (V. St. P. 275340) verstärkt das Siebzeug durch untergelegte Siebe verschiedener Maschengrösse.

W. Liess' (V. St. P. 275, 391) Absetzkästen für Stärke sind speciell für leichte Handhabung construirt.

Einige Neuerungen am Trockenapparat von Hersey, (149397) lieferte E. Roat (275858).

L. Best (V. St. P. 278480) erstrebt eine Mehrgewinnung von Stärke durch Uebermahlen der grossen Abfälle und verbessert die Verwendung der Waschwässer in der Stärkefabrikation, mit denen gewöhnlich grosse Verschwendung getrieben wird.

Ein Mittelding zwischen der Soda- und der Schwefligsäureweichmethode ist das Patent Kingsford (V. St. P. 280044) geworden. Er weicht den Mais in Kalkwasser 60—72 Stunden lang und mahlt nachher wie gewöhnlich. Der Brei wird in Bottichen gesammelt und mit SO^2 behandelt.

B. Stärkezucker.

Durch erneutes Uebermahlen des Maischguts und Absieben der Hülsen will Duff (V. St. P. 260853) alle Stärke in den Zellen blos legen und der Conversion zugänglich machen.

Zum Abkühlen und zweckmässigen Entleeren krystallisirender Stärkezuckerlösungen haben J. u. F. Firmenich (V. St. P. 261819) einen Cylinder mit konischem Boden construirt. Die Wände sind doppelt, um durch dieselben sowol abkühlen als auch, erstarrten wieder aufwärmen zu können. Solche Gefässe haben zweifelsohne grossen Wert für leichte und schnelle Verarbeitung von Zuckerlösungen während der Krystallisation.

Eine neue Methode zum Mischen von Stärkezucker und Rohrzucker hat T. Jebb (V. St. P. 264035) eingeführt in der Absicht, dem ersteren seine weiche Consistenz zu nehmen. Stärkezuckerlösung wird mit pulverisirtem

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Rohrzucker zum Erstarren gebracht, die feste Masse nachher getrocknet und zerkleinert. (Vgl. S. 280.)

H. Bartol (V. St. P. 264222) führt an, dass bereits seit 1842 dahin gestrebt wird, Stärkezucker direct aus den stärkeführenden Samen zu gewinnen. Auch hat man seit langem verdünnte Alkalilösungen zum Ausziehen des Gluten benutzt. Aber als neu reservirt sich der Erfinder die Verwendung von warmen Lösungen verdünnter Säuren und Alkalien zum Extrahiren des Gluten und Oels bei einer Temperatur von 90—120° F. Der Erfinder unterscheidet sein Patent von dem Johnson's (186935) dadurch, dass dieser nicht warme Lösungen anwendet und gleich von Anfang die starke Säure zum Einweichen benutzt und nachher convertirt, ohne die gesättigte Säure zu erneuern.

W. Brittingham (V. St. P. 266268) gewinnt aus Cacteen Traubenzucker.

F. Firmenich (V. St. P. 266279) beschreibt eine neue Zuckerpfanne für die Fabrikation von Block-Stärkezucker. Zur schnellen Reinigung solcher Pfannen legt er sie vor dem Füllen mit Tuch aus. Der harte Block kann dann leicht herausgenommen werden, ohne dass Stücken kleben bleiben.

Ch. Lauga (V. St. P. 267546) oxydirt die Glucosewaschwasser aus den Filterpressen mit Ozon, fügt noch Phosphorsäure hinzu und couvertirt mit dieser Flüssigkeit ganzes Getreide. Man neutralisirt mit Erdsaccharaten und verfährt im übrigen nach der gewöhnlichen Methode.

Die bei der Einwirkung von verdünnter Schwefelsäure auf Nichtstärke entstehenden schädlichen Nebenproducte glaubt A. Fell (V. St. P. 268653) durch Behandlung der Zuckerlösung mit schwefliger Säure unter Druck zerstören zu können.

H. Endemann (V. St. P. 269779) schlägt vor, Stärke mit Orthophosphorsäure zu convertiren, um gypsfreie Glucose zu erzeugen.

A. Fell hat gefunden (V. St. P. 270042), dass man die nach dem Neutralisiren gelöst bleibenden Eiweissstoffe in Stärkezuckerlösungen des dry process-Verfahrens durch Kälte abscheiden kann.

Einen sehr compendiösen Converter empfiehlt F. Stricker (V. St. P. 270260). Die Stärkemilch wird convertirt, während sie in einer spiralförmigen Rinne durch einen Converter läuft:

Eine „neue" Zusammenstellung bekannter Thatsachen hat Bartol den Technikern in seinem Patent (276334) präsentirt. Er convertirt ganzes Getreide, behandelt nach dem Filtriren mit schwefliger Säure, filtrirt über Kohle und Dampf zu gewünschter Dicke. In Gemeinschaft mit A. Landry hat C. Lauga (V. St. P. 278562) vorgeschlagen, mit gasförmiger Chlorsäure und und Ueberchlorsäure zu convertiren (!). Sie haben zwei geschlossene Kochtöpfe und drücken die unbenutzt gebliebene gasförmige (!) Säure einer Conversion in den frisch gefüllten zweiten Converter. Dieses Patent scheint durch die fehlerhafte Idee Lauga's (267546) entstanden zu sein, dass activer Sauerstoff einen Haupteinfluss übe bei der Conversion der Stärke. Beim Ozonisiren der Waschwässer soll der Stickstoff der Albuminate in Stickoxydgas

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übergeführt werden und dieses aus der Glucose eine Anzahl organischer Säuren bilden, wie Zucker-, Ameisen-, Humussäure. Diesen „oxydirenden" Gedanken haben die beiden Erfinder im Kopf gehabt bei der Verbesserung ihrer Methode der Conversion durch Sauerstoff abgebende Körper. So macht man Glucose in New-Orleans, Louisiana, V. St. A.!

Eine Methode der Conversion mit Kohlensäure und Dampf hat W. Decastro (V. St. P. 279354) beschrieben.

T. Kingsford (V. St. P. 280045) bringt den nach seinem Patent 280044 erhaltenen Brei in geschlossene Converter und kocht mit ein pro Mille (Getreide) starker Salpetersäure. Nach dem Neutralisiren dampft man ein auf 20° B, wobei aller Gyps ausfällt (?), filtrirt wieder und klärt mit Kohle.

P. Radenhausen, Davenport, Iowa.

XXIII. Wein.

I. Die Rebe.

Neue Reben. Die Entdeckung einer neuen knollentragenden Rebart wird von J. B. Martin aus Cochinchina (Weinlaube 1882, 53 und 160), von H. d'Arpoare aus Guinea und den Provinzen des Cap Vert gemeldet, und auch die japanischen Reben werden von den Franzosen in Betracht gezogen (Weinbau 1882, 213). Die wild wachsenden kaukasischen Reben werden von Scharrer (Tiflis) als der Anbauversuche wert genannt. (Ampelographische Berichte 1882, No. 3.)

Düngung und **Bodenbearbeitung.** Bei Versuchen über Verwendung von Kunstdüngern zur Weinbergsdüngung an Stelle des kostspieligen und schwer transportablen Stalldüngers stellte sich der grosse Wert der ersteren auch für Weinbergsdüngung heraus. (Weinbau 1882, 207 und Zeitschr. d. landw. Ver. Rheinpr. 1882, 42.) Auch Kali- und phosphorsäurereiche Schiefermehle gaben gute Resultate. (Weinbau 1882, 163.) Auf einen Weinbergspflug mit leicht zu handhabender Stellvorrichtung erhielt H. Thiney in Prusy (Frankreich) das D. P. 16386.

Erziehung. Zur Conservirung der Rebpfähle taucht J. Troost dieselben in eine heisse Mischung von 10 kg amerikanischem Harz, 15 kg Steinkohlenteer, 3·5 kg ordinärem Fett, 2 kg gebranntem Gyps und 2 kg Schlemmkreide. (Weinbau 1882, 208.) Eiserne Rebpfähle mit Erhöhung zur Unterstützung der Drahtzüge sind W. Schmidt in Schlebusch bei Köln durch D. P. No. 18735 patentirt. Als Bindemittel werden Cocosfaserstricke von C. Gruhle, Leipzig, in den Handel gebracht. (Weinlaube 1882, 175.)

Das Kappen der Reben ist nach Müller's-Thurgau Versuchen bei Reben in weitem Satz und von geringer Triebkraft entschieden nachteilig und daher für diese zu unterlassen. (Weinbau 1882, 95.)

In Südfrankreich werden die Reben als „Kriechende Reben" (*enchaintres* oder *vignes rampantes* in grosser Entfernung von einander mit

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langen Ruten frei an der Erde hinwachsend erzogen und nur zur Zeit der Traubenbildung durch kleine Gabeln gestützt. Man hofft, dass durch diese Cultur die Reben, weil sie ihrem natürlichen Triebe folgen können, widerstandsfähiger gegen die Reblaus sein werden. Die Erträge sind hoch und die erste Bestockung wesentlich billiger. (Weinlaube 1882, 553.)

Das Setzholz bewahrt A. Dannhäuser über Winter auf, indem er die Schnittlinge 30—40 cm tief nebeneinander in Erdgruben einlegt und bei Frost mit Laub deckt. (Weinbau 1882, 20.)

H. Müller-Thurgau führte grössere Versuche über die künstliche Bastardirung verschiedener Rebsorten aus. (Weinbau 1882, 103.)

Feinde der Rebe. Die Reblaus macht immer weitere Fortschritte. Sie breitet sich sowohl von den alten Infectionsstellen aus weiter über anliegende Rebgelände aus, und taucht auch plötzlich an ganz entfernten Stellen auf. In Niederösterreich fanden sich vier neue Herde (Weinlaube 1882, 306, 342, 391, 438, 511), in Ungarn 18 (l. c. 306, 318, 331, 342, 353, 367, 379, 392, 403, 416, 462 und 525). Auch in Steiermark fand sich der Rebschädling (l. c. 341). In Frankreich zeigte er sich in den bisher nicht inficirten Arrondissements Châtellerault (Vienne), Nautua (Ain), Limoges (Haute-Vienne), Fontenay (Vendée), Fontainebleau (Seine-et-Marne) und Aurillac (Cantal). (Ampelographische Berichte 1882, 125 und Weinlaube 1882, 451, 486, 569.) Auch in der Schweiz wurden bei den alten Herden von Neuchâtel, Cambesy und Genf neue aufgefunden (Weinlaube 1882, 439 und 512). Da die Staatsrebschule der italienischen Regierung auf der Insel Monte-Christo auch inficirt befunden wurde, so erfolgte die Vernichtung aller angepflanzten Reben (Weinbau 1882, 80). In Spanien verbreitete sich die Reblaus in den Districten von Malaga über 72 000 Acres und machte auch in Catalonien Fortschritte (Weinlaube 1882, 8 und 534). In Portugal sind 130 000 ha inficirt, neue Stellen in der Provinz Beira aufgefunden (l. c. 163). In Serbien fand man die Reblaus bei Semendria und Przarevac (l. c. 428), während ihr Auftreten in Kaukasien entschieden abgeleugnet wird (Ampelogr. Berichte 1882, No. 3). Der immer drohender werdenden Gefahr versuchen die Regierungen von Oesterreich-Ungarn, Serbien, Spanien und Russland durch Verschärfung der Einfuhrverbote von Reben, Rebteilen etc. vorzubeugen (Weinlaube 1882, 391, 223, 512; Weinbau 1882, 20). In Portugal werden Syndicate nach Art der französischen, vom Staate subventionirten, eingerichtet und Schwefelkohlenstoff aus einer Staatsfabrik zu niedrigem Preise abgegeben (Weinlaube 1882, 138 und 163); in Ungarn giebt das Ministerium Proben amerikanischer Rebkerne zur Anpflanzung ab (Weinlaube 162).

Hennegüy bestätigt die Zusammengehörigkeit der Blatt- und Wurzelform der Phylloxera (Comptes rendus XCV, 1136). Durch Züchtungsversuche im Warmhause fand Lichtenstein, dass die Ausbildung der geflügelten Form wesentlich von der Temperatur abhängig ist und glaubt hieraus und aus dem Umstande, dass im Süden die Vermehrung der Wurzellaus eine viel früher beginnende und deshalb grössere sei, erklären zu können, weshalb die Be-

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kämpfung der Reblaus in den Ländern jenseit der Grenze der Olive und Feige eine viel leichtere ist (Comptes rendus XCIV, 1397 und XCV, 1453). Balbiani empfiehlt, mehr die Zerstörung des Wintereies zu betreiben (l. c. XCIV, 708 und 1027).

Die Bekämpfung der Reblaus wird mit den seither verwendeten Mitteln fortgesetzt und neue Mittel tauchen von Zeit zu Zeit auf, von denen die meisten sich schliesslich als unbrauchbar erweisen. Eine lehrreiche Zusammenstellung alles bisher über die Wirkungen des Schwefelkohlenstoffes und der Sulfocarbonate Bekannten hat die Commission zur Beratung der Schwefelkohlenstoff- und Sulfocarbonatfrage auf dem Phylloxeracongress zu Bordeaux verfasst (Weinlaube 1882, 61).

Zur Einbringung des Schwefelkohlenstoffes in den Boden ist von der anonymen französischen Gesellschaft „Reconstruction viticole" ein pflugartiger Apparat construirt und mit dem Namen „Sulfureuse" belegt, welcher zugleich Furchen zieht, Schwefelkohlenstoff in dieselben in bestimmter Menge einführt und sie wieder schliesst. (Weinlaube 1882, 445.)

Zur Wertbestimmung der Sulfocarbonate sind zwei Methoden angegeben. Die eine von A. Gélis und Thommeret-Gélis beruht auf Abscheidung des Schwefelkohlenstoffes mit Natriumbisulfit und Messen des entstandenen Volums (Compt. rend. 1882, XCV, 967). Die andere von Lombard de Bouquet bewirkt die Abscheidung von CS^2 mit Kupfersulfat in der Hitze und Zersetzung desselben im rotglühenden Rohr. Die schweflige Säure wird in Bromwasser aufgefangen und als Schwefelsäure bestimmt. (Ber. d. d. chem. Ges., Berlin 1882, 2933.)

Nach Versuchen von Horvath erwies sich Schwefelleber weniger wirksam gegen die Reblaus als Schwefelkohlenstoff (Weinlaube 1882, 571.)

Das Erdpech von Judäa ist zu Versuchen in Frankreich vom Ministerium eingeführt worden. (Compt. rend. XCIV. 406, 569, 704.)

Naphtalin wird von E. Fischer (La naphtaline en médecine et en agriculture, Strassburg, Trübner), Phenol, in 1-proc. Lösung der Rebe injicirt, von Maudon (Weinbau 1882, 147), Mischungen von Chlorkalk und Salmiak (Weinlaube 1882, 8), Eisenvitriol von Pellicot und Jaubert (Compt. rend. 1882, XCV. 21) als Mittel gegen die Phylloxera empfohlen. Grössere Versuche fehlen aber. Das „Anti-Phylloxera-Oel" von A. Roux ist wirkungslos. (Weinlaube 1882, 223.)

Als Düngergemische mit insecticiden Eigenschaften werden genannt: Von M. Perret, abgeschnittenes Rebholz 25 000, Stallmist 25 000, Kalksuperphosphat 1 200, Chlorkalium 250, Kupfervitriol 100. (Compt. rend. 1882, XCV. 975). Von A. Boyreau, phosphorsaures Natron 15, phosphorsaures Ammon 5, Salmiak 20, schwefelsaures Kali 15, Soda 25, Schwefelblumen 30. Eisenvitriol 890. (D. P. 17886.)

Die Abwässer von Wollwäschereien benutzt J. Maistre mit Erfolg zur Bewässerung seiner Rebberge. (Compt. rend. 1882, XCV. 474.)

Foex teilt mit, dass nur in Sandböden von mehr als 60 Proc. Kiesel-

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erde die Reben von der Phylloxera verschont bleiben und giebt Anleitung zur Cultur der Reben unter solchen Bedingungen. (Weinlaube 1882, 568.)

In übersichtlicher Weise fasst G. Foex die bisher gesammelten Erfahrungen über die Cultur der im südlichen Frankreich gezüchteten Amerikanerreben zusammen (Manuel pratique de viticulture pour la reconstitution des vignes méridionaux; Montpellier 1881) und H. Goethe schliesst seine eigenen Erfahrungen dem an. (Weinlaube 1882, 14.)

In französischen Blättern werden als widerstandsfähige Europäer-Reben genannt: *Mourisco preto* (Portugal), *Braquet* (Nizza) und *Vitis nocera* (Sicilien). Solche Anpreisungen sind mit Vorsicht aufzunehmen. Weinlaube 1882, 463.) Die meisten Amerikanerreben besitzt zur Zeit das Departement Hérault auf über 5 000 ha. (l. c. 295.)

Andere tierische Rebschädlinge. Sein Gift gegen den Heu- und Sauerwurm stellt Nessler jetzt verdünnter her, 40 Proc. Fuselöl, 30 Proc. Schmierseife pro Liter, da das concentrirtere die Rebblüten beschädigte. (Weinbau 1882, 174.) Der Springwurmwickler wird nach Jaussan am besten durch Verbrühen vernichtet, und dazu ist ein eigener Kessel construirt, von dem aus der heisse Wasserstral an die Reben geleitet wird. (Weinl. 1882, 243.) Eine Rebenblattlaus (Aphis vitis), welche Lichtenstein an Reben fand, hält er für unschädlich. (Compt. rend. 1882, XCIV. 1 500.) Eine neue Rebenschildlaus (Aspidiotus uvae Comst.) fand Boerner (Indiana) auf. (Weinl. 381.) Der Rebendreher (Sinoxylon bispinosum Oliv.) durchbohrt die Rebzweige in einer Spirale. (Ampelographische Berichte 1882, No. 4.) Eine Art Bockkäfer (Vesperus Xatarti) beschädigt die Wurzeln der Reben in Spanien, Portugal und Frankreich. (Weinl. 1882, 56 und 67.)

Pflanzliche Parasiten. Gegen das Oïdium wurde schon seit langer Zeit das Schwefeln der Reben mit Erfolg ausgeführt. Ueber die Wirkungsweise des Schwefels waren aber bisher die Ansichten verschieden, nach den Untersuchungen von J. Moritz und dann von Basarow und Salomon ist aber jedenfalls Bildung von schwefliger Säure die Ursache der Wirkung. Die beiden Letzteren konnten in der Luft eines geschwefelten Rebstückes 0·009 Gewichtsprocente schwefliger Säure nachweisen. (Weinlaube 1882, 530.)

Bei zu grosser Hitze ist das Schwefeln nach Ortlieb zu vermeiden, da die Beeren beschädigt werden. (Weinbau 126.) Reich und Rasch bekämpften Oïdium und Brenner wirksam durch Abwaschen des jungen Holzes mit Kupfervitriollösung im Frühjahr. (Ampel. Ber. 1882 No. 1—2.)

Die Peronospora viticola machte bedeutende Fortschritte. Sie drang nach Deutschland (Elsass und Rheingau) vor (Ampel. Ber. No. 3 und Weinbauber. 569), verbreitete sich über Italien (Ampel. Ber. No. 3) und Ungarn (Weinlaube 537), auch in Algier richtete sie Verwüstungen an (Ampel. Ber. No. 5). Der Pilz greift nicht nur die Blätter und Triebe, sondern endlich auch die Beeren an, wie Cavazza aus Italien, Prillieux aus Frankreich gleichmässig berichten

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(Ampel. Ber. No. 3 und Compt. rend. XCV 527). Der Letztere beobachtete auch die Orsporenbildung. Als neues Mittel gegen den Pilz wird Bestäuben der Reben mit einer Mischung von Eisenvitriol und Gyps genannt (Weinlaube 1882, 220). R. Goethe fand, dass auf der Reblaus widerstehenden Amerikanerreben der Pilz auch nicht vorkam (Weinbau 1882, 179).

Prillieux betrachtet nach seinen Untersuchungen als Ursache der in Amerika auftretenden Traubenfäule (rot.) die Peronospora, während der Pilz Phoma uvicola, der sich gewöhnlich bei der Traubenfäule zeigt, erst secundär auftritt. (Compt. rend. 1882 XCV 605.)

Die als „Aubernage" im Departement Yonne auftretende Krankheit führt Roumeguère auf das Zusammenwirken von Phoma vitis, Phoma pleurospora und Sphaerella Pampini zurück. (Ampel. Ber. 1882 No. 4.)

Neben der Peronospora bechädigt am Genfer See und in Ober-Italien der zu den Cladosporen gehörige Pilz Torula dissiliens die Reben. (Weinbau 1882, 179.)

R. Goethe teilt seine Erfahrungen über die verschiedene Widerstandsfähigkeit der verschiedenen Rebsorten gegen Frost mit. Interessant ist die Beobachtung, dass weder die unter der Schneeschicht gelegenen, noch die über 1 m hoch stehenden Rebteile Frostschäden zeigten. (Weinlaube 1882, 164.) v. Babo lässt eine Notrebe senkrecht und frei im Winde beweglich stehen, welche, wenn kein Frostschaden eintrat, fortgeschnitten wird, im anderen Falle horizontal gezogen einen geringen Ertrag liefert. (l. c. 184.)

Als Ursache des „Ausreissens" der Trauben, d. h. Ausbleiben der Fruchtbildung nach scheinbar guter Blüte, fand Molnar eine anormale Stellung der Staubbeutel, welche die Befruchtung unsicher macht. (l. c. 326.)

Die „Jungferlnbildung", d. h. Auftreten kleiner, kernloser Beeren, nach Art der Corinthen, ist nach Mach die Folge einer blattförmigen Ausbildung der Nektarien und Staubfäden, welche sogenannte gefüllte Blüten erzeugt. (l. c. 19.)

2. Most.

Ueber die Periodicität guter Weinerträge und ihren Zusammenhang mit derjenigen der Sonnenflecken macht Fritz Mitteilungen (Weinbau 1882, 126). Der Einfluss grosser Trockenheit des Bodens zur Reifezeit machte sich nach Mach nicht nur auf die Grösse des Ertrages, sondern auch auf den Säuregehalt des Productes geltend (Weinlaube 1882, 42). Den grossen Nutzen der Auslese für Erzielung guter Producte weist Simacek durch Zusammenstellung der Säure- und Extractgehalte der Moste 1881er Ernte aus den verschiedenen Teilen der Auslese schlagend nach. (l. c. 125.)

Die Firma Pini Sante (Wien) verfertigt eine Rebelmaschine bei welcher eine mit 3—4 cm langen scharfen Spitzen besetzte Trommel sich in einem ebenso armirten Mantel bewegt. Die Beeren fallen fast unverletzt unterhalb derselben heraus, die Kämme werden durch eine zweite mit längeren Spitzen versehene Walze ausgeworfen. (Weinlaube 1882, 75.)

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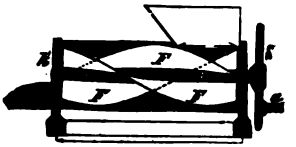
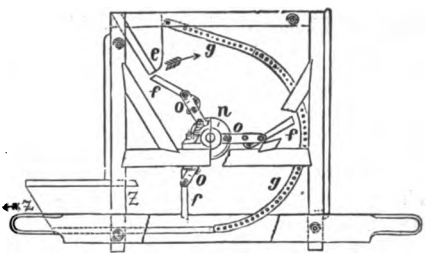
Georg Schäfer in Königswinter a. Rh. Trauben-Abbeer-Maschine. (D. P. 16444 vom 22. April 1881.) Dieselbe besteht aus einem auf seinem Gestell befestigten, horizontal liegenden Cylindersieb, in welchem eine mit drei schraubenartigen Flügeln *F* besetzte Welle *A* rotirt. Die drei Flügel aus verzinktem Eisenblech befinden sich um 120° gegen einander versetzt auf der Welle. Der Antrieb der Welle mit den Flügeln erfolgt vom Handgriff *a* am Schwungrad *S* aus. Ein vierseitiger Trichter auf dem Cylindersieb dient zur Aufnahme der abzubeerenden Trauben. Aus diesem Trichter gelangen die Trauben in das Innere des Cylindersiebes und werden durch die Drehung der mit den drei schraubenförmigen Flügeln besetzten Welle über die Innenseite des Cylindersiebes gerieben. Die abgetrennten, teils ganzen, teils zerdrückten Beeren fallen durch die Cylindersiebmaschen in einen unter den Apparat gestellten Bottich während die Rabben von den Flügeln durch die Oeffnung der Kopfseite *k* des Cylinders herausgedrängt werden.

Fig. 206.



L. Brüggemann in Heilbronn. Trauben-Abbeer-Maschine. (D. P. 19620 vom 7. Februar 1882.) Die Trauben gelangen durch den Einlauf *e* auf die Flügel *f*, welche an dem äussersten Ende der auf den Scheiben *n* festgeschraubten Speichen *o* sitzen. Die Flügel sind aus Holz oder Metallstäben rechenartig zusammengestellt. Im Innern des Gestelles ist ein Gitter *g*, das durch horizontal gelegte Stäbe gebildet wird, so befestigt, dass es die von dem Flügelrade beschriebene Kreisbahn teilweise umgiebt. Durch die Flügel *f* werden die Trauben gegen das Gitter *g* geschleudert, wobei die Beeren, von den Kämmen getrennt, durch dasselbe gelangen, während die Kämme bei *Z* aus der Maschine geführt werden.

Fig. 207.



Eine Traubenmühle mit Stahlblechwalzen stellt R. Martin (Offenburg) her. (Weinbau 1882, 151.)

Weickum's Differenzial-Weinpresse hat bei horizontal liegendem Presskorbe und horizontal gerichteter Pressbewegung den grossen Vorteil, dass der Presskuchen äusserst leicht ohne ein Auseinandernehmen der Pressteile entfernt werden kann. (Weinlaube 1882, 469.)

Auf eine Presse für Trauben, Tabak etc. mit verstellbarem Hebelwerk, Rührvorrichtung und Büttenverschluss erhielt Schiffmann, Mülheim a. d. Mosel das D. P. 15911 vom 9. Februar 1881.

Zum Stummachen eines Mostes genügen schon sehr geringe Mengen schwefliger Säure; B. Haas fand in einem 2 Monate im Keller lagernden

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Moste nur 0·0121 Proc. schwefliger Säure. (Berichte d. D. Chem. Ges. Berlin 1882, XV. 159.)

Zum Eindicken von Most verwenden Gebr. Mussi (Mailand) einen Apparat, bei dem die Concentration im luftverdünnten Raum bei 30—32° vor sich geht. Die eingedicken Moste spielen bei der Süssweinbereitung eine wichtige Rolle. (Weinlaube 1882, 64.)

Das Trocknen der Weintrauben zur Rosinenerzeugung nimmt die Manufacturing Company in Waynesboro in besonderen Apparaten im heissen Luftstrom vor. (l. c. 488.)

3. Wein.

a. Weinbereitung und -behandlung. Pascotini (Pettau) verhütet Kohlensäureansammlung in seinen Gährkellern, indem er die Kohlensäure von dem Gährspund der Fässer in ein Sammelrohr und von diesem aus durch die Kellerfenster in's Freie leitet. (Weinlaube 1882, 16.)

Eine Verbesserung von Hebelpumpen, welche leichten Zugang zu den Kugelventilen und Reinigen dieser gestattet, hat Syrowy (Wien) angebracht. (l. c. 495.)

Einen Messapparat zum Einschalten zwischen Pumpe und Fass, welcher durch Uhrwerk und Glockenzeichen je 25 Liter angiebt, liefert Garolli (Limena, Italien). (l. c. 86.)

Zur Verhütung des Ueberlaufens beim Füllen der Fässer mittelst der Pumpe dient ein Apparat, bei welchem der Ueberschuss an Flüssigkeit in das Rohr eintritt aus dem zu Anfang die Luft entwich, dort einen Schwimmer hebt, der das Rohr schliesst.

G. A. Beck und G. E. Reich (Dresden) erreicht ein gleiches durch einen Schwimmer am Fassfülltrichter, der gehoben ein Glockensignal giebt. (D. P. 18202 vom 16. September 1881.)

Thönerne Weingefässe in verzierten Formen stellt die Hruschauer Thonwaarenfabrik her. (Weinlaube 1882, 147.)

Benno Wolf in München. — Apparat zum Conserviren von Wein und Bier. (D. P. 14358 vom 28. November 1880).

Einen Flüssigkeitsmesser in Hahnform, welcher Flüssigkeitsmengen von $^1/_4$ oder $^1/_2$ Liter, resp. Multipla diesen Mengen abzumessen gestattet construirte Lorenz (Schaffhausen). Weinlaube 1882, 482.)

Für Flaschenreinigungsapparate verschiedener Construction erhielten Boldt & Vogel in Hamburg und Kalle in Berlin die D. P. 17064 vom 19. August 1881 resp. 18315 vom 30. Juli 1881.

Maschinen zur Prüfung von Champagnerflaschen gegen einen momentanen Druck von 20 Atmosphären stellen Gebr. Schulz in Mainz her. (Weinl. 1882, 100.)

Entgegen der Ansicht Nessler's, fand Moritz Sodalösung brauchbarer zum Ausbrühen neuer Fässer als Schwefelsäure. (Weinbau 1882, 55.)

Rührvorrichtungen zum Schönen stellten Lebeuf und Carpené

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her, ersterer in Form sichelförmiger, zusammenlegbarer Flügel, letzterer in Form von Rührstäben, welche wie bei einem Schirm ausgespannt oder angelegt werden können. (Weinl. 1882, 110 und 111.)

Zum Schönen von Mosten zur Champagnerbereitung mit Tannin und Hausenblase ist nach F. Jean von dem bisherigen rein empirischen Zusatz abzugehen und auf Grund der Bestimmung des wahren Tanningehaltes (da der Most auch Oenogallussäure enthält) und der von den Eiweissstoffen fällbaren Tanninmenge der Tanninzusatz, und da 82·8 g Tannin 100 g gelöster Hausenblase entsprechen, auch deren Menge für jeden Fall festzustellen. Zur Bestimmung bedient sich Jean der in diesem Jahresber. 1881/82 S. 201 angegebenen Methode. (Compt. rend. 1882, XCIV. 800.)

Auf ein Klärverfahren mittelst Hausenblase und schwefligsauren oder sauren schwefligsauren Alkalien erhielten A. Boake und F. G. Roberts das D. P. 17545 vom 1. April 1881.

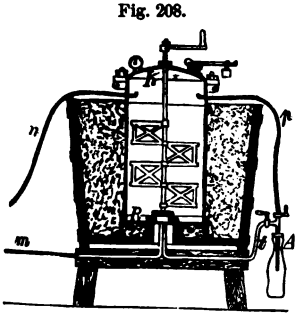
Richard Jacobsen in Berlin (D. P. 21591 vom 22. Juli 1882) benutzt zur Klärung von Wein, Bier und Spirituosen ungeleimtes Papier, Papierstoff, Cellulose oder ähnliches Material, welches mit Klärmitteln wie Eiweiss, Hausenblase, Gelatine oder Tannin imprägnirt ist. Dabei kann ein bestimmtes Format des Papiers einem bestimmten Quantum zu klärender Flüssigkeit entsprechen. Vor dem Gebrauch wird die Masse aufgeweicht.

Mitteilungen über die jetzt übliche Bereitungsweise der Ausbruchweine und Winke für die praktische Ausführung der Süssweinbereitung giebt v. Babo. (Weinl. 1882, 4.)

F. Ganther untersuchte vergleichsweise nach gewöhnlichem und nach dem Reihlen'schen*) Verfahren bereitete Weine und konnte in letzteren eine erhebliche Steigerung des Gehaltes an Extract, Alkohol und Farbe feststellen. (Weinbau 1882, 125.)

Antoin Carpené in Conegliano, Italien. — Verfahren und Apparat zur Erzeugung von Schaumwein und Eis. (D. P. 19531 vom 31. Januar 1882.) Der Wein oder die andere Flüssigkeit wird bei einer Temperatur von —6° und einem Druck von 1—1½ Atmosphären in einem kupfernen, verzinnten oder versilberten Kessel *k*, der in einem Eisbehälter steht, und der mit einem Rührapparat versehen ist, aus einem Gasometer vermittelst einer Pumpe und Rohr *m* mit Kohlensäuregas imprägnirt. Die Kohlensäure wird durch den durchlöcherten Boden *R* fein verteilt. *t* ist das Ausgangsrohr für den gesättigten Wein. Die zu füllende Flasche ist mit einer Kautschukkappe versehen. Das Rohr *p* dient zur Herstellung des Gleichgewichts des Druckes im Innern der Flasche und des Apparates. Durch *n*

Fig. 208.



*) Techn.-chem. Jahrb. 1883, S. 192.

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gelangt atmosphärische Luft in den Kessel. Bei etwa —10° bildet der Wein gefrorenen Schaumwein. Der kalte Schaumwein schäumt weder, noch treibt er die Stöpsel aus der Flasche, und bedarf bei einer Temperatur von 0° nur einer leichten Verkorkung. Die Korke werden sogleich oder am nächsten Tag verbunden.

A. Girard teilt interessante Untersuchungen über Tresterweine mit, welche er sich selbst bereitete. Aus diesen geht hervor, dass alle durch einmaliges Vergähren von Zucker über Trestern (und Abziehen nach beendigter Hauptgährung) erhaltenen Weine bei einem Alkoholgehalt von 9—11 Proc. eine geringere Extractmenge enthalten, als die entsprechenden Naturweine, aus Most vergohren; dieselbe beträgt 50—75 Proc. der letzteren. Auch die Weinsteinmenge, der Gerb- und Farbstoffgehalt und die Farbenintensität sind weit geringer, in je nach der Tresterart schwankenden Zahlen, als bei Naturweinen aus Most. Bei längerem Belassen des Weines auf den Trestern wurde der Weinstein- und Gerb- und Farbstoffgehalt nicht nur nicht höher, sondern verminderte sich im Gegenteil. Die Verdoppelung der angewandten Trestermenge (500 statt 250 g Trester auf 1 Liter Zuckerwasser) erwies sich auch ohne Erfolg für die Anreicherung an Weinbestandteilen. Waren die Trester von entrappten Beeren zurückgeblieben, so empfiehlt sich ein Zusatz von der Hälfte des Trestergewichtes an Kämmen, da hierdurch der Gerbstoffgehalt fast auf den des Naturweines gehoben wird. Endlich spricht sich Verf. entschieden für Zulassung der Tresterweine zum Markte aus als in sanitärer Hinsicht den reinen Weinen zwar nachstehender aber doch gesunder und billiger Getränke. (Compt. rend. 1882, XCV. 227.)

Man ist in Frankreich überhaupt weniger gegen das „Verbessern" der Weine eingenommen, wie bei uns, wie aus dem Gutachten der Société d'Agriculture de France an den Finanzminister hervorgeht, welche die „sucrage" der Weine und das einmalige Petiotisiren mit Rohrzucker nicht nur für ratsam hält, sondern eine Herabsetzung der Zuckersteuer zur Unterstützung der Zuckerung befürwortet. (Weinlaube 1882, 339.)

Nach recht eingehenden Versuchen erklärt von Mehring die unvergährbaren Bestandteile (Dextrine) des Kartoffelzuckers für unschädlich. (Ber. d. deutsch. chem. Ges. Berlin 1882, 955.)

In einem Gutachten an die Berner Regierung spricht sich Nencki für Festhalten der Grenze von 2 g Kaliumsulfat im Liter für gegypste Weine aus, da zwar die Schädlichkeit daran reicherer Weine nicht erwiesen, wohl aber möglich sei. (Journ. f. prakt. Chemie 1882, XXV. 284.)

Charles William Ramsay in Brooklyn. Das Verfahren, destillirte und gegohrene Getränke zu oxydiren oder alt zu machen (D. P. 14381) besteht darin, dass die betreffende Flüssigkeit in Schaum und in fein zerstäubte Form gebracht wird und in dieselbe atmosphärische Luft oder reiner Sauerstoff während dieses Zustandes eingeführt wird. Hierbei sollen nach D. P. 14360 auch Gärung bewirkende Organismen vernichtet werden.

b. Krankheiten und ihre Heilung. J. Moritz fand, dass zur Ver-

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hütung der Kahmbildung die Anwendung von einer Schwefelschnitte auf ein Halbstückfass (600 l) und $1^1/_2$ pro Stückfass, wie die Praxis lehrt, auch theoretisch gerechtfertigt ist, da 0·0198 Proc. schwefliger Säure die Kahmbildung um 77 Tage verzögert, eine Menge, die fast genau aus der in der Praxis angewandten Schwefelmenge entsteht. Ferner empfiehlt Verf. die Schwefelschnitten von F. Schaupert (Stuttgart), da sie nicht tropfen und billiger sind, drei derselben entsprechen einer gewöhnlichen. (Weinbau 1882, 52 und 87.)

Trübe italienische Weissweine klärte Carpené durch Zusatz von 12—30 g schwefligsaurem Kalk und 200 g Weinstein pro Hektoliter. (l. c. 158.)

A. Denucée, Bordeaux, hält einen Zusatz von 10—40 g Salicylsäure auf den Hektoliter Wein, Bier etc. für entschieden zulässig und unschädlich. (Weinbau 1882, 44.)

c. Bestandteile des Weines. Analysen badischer, rheinhessischer und Pfälzer Weine des Jahres 1881, auffällig wegen ihres hohen Alkoholgehaltes neben viel freier Säure und selbst freier Weinsäure, teilt Nessler mit (Weinbau 1882, 15); Analysen von Markgräfler Weinen giebt H. Wachter (l. c. 91), von Lothringer Weinen C. Weigelt (Zeitschr. f. Wein-, Obst- und Gartenbau in Elsass-Lothringen 1883, No. 3). Analysen von ungarischen auf der Stuhlweissenburger Landes-Ausstellung ausgestellten Weine finden sich in der Weinlaube 1882, 112. Analysen von Werschetzer Weissweinen teilt V. Wartha mit (l. c. 99), von Dalmatiner Weinen Mitrovic (l. c. 573). Weine von Palästina, Kleinasien, Griechenland und Kalifornien untersuchte A. Stutzer (Bonn) (Repert. d. analyt. Chemie 1882, No. 14). C. Schmitt (Wiesbaden) veröffentlicht Analysen deutscher und der besten französischen Schaumweine und giebt an: „die besseren deutschen Marken unterscheiden sich von den vielgepriesenen Producten bekannter französischer Firmen, so weit wir es vom Standpunkte des Chemikers aus zu beurteilen im Stande sind, überhaupt nicht". (Repert. f. analyt. Chemie 1883, No. 6.) Endlich geben Fresenius und Borgmann eine Zusammenstellung der Maximal-, Minimal- und Mittelgehalte aller von ihnen analysirten Naturweine an den einzelnen Bestandteilen. (Zeitschr. f. analyt. Chemie 1883, 46.)

Eine Vereinbarung von analytischen Chemikern Süddeutschlands über möglichst einheitliche Methoden bei Ausführung von Wein-Analysen kam zu Neustadt a. H. und Mainz zu Stande (Repert. f. analyt. Chemie 1882, No. 20) und auch bei der Generalversammlung des Vereins analytischer Chemiker in Berlin am 17. Juni wurden gewisse Methoden als maassgebende durchberaten. Die auf der Versuchsstation für Wein- und Obstbau in Klosterneuburg bei Wien üblichen Methoden beschreibt L. Rösler in den Mitteilungen der Station 1882.

Die Analyse eines Apfelmostes und des daraus gewonnenen Apfelweines teilt Kayser mit (Repert. f. analyt. Chemie 1882, No. 23).

Ueber die Möglichkeit der Nachweisung, ob ein Wein chaptalisirt, petiotisirt oder gallisirt sei, hat Kayser durch Analyse von Mosten

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und daraus bereiteten Kunstweinen sich ein Urteil zu bilden gesucht und glaubt, dass die beiden ersteren Fälle nur bei ungeschickt geleiteter Operation, der letztere aber mit Sicherheit nachgewiesen werden kann. (Repert. f. analyt. Chemie 1882, No. 6.)

Den Extractgehalt von meist einjährigen Tiroler Weinen stellten Mach und Portele fest und fanden als niedrigste Zahlen bei Weissweinen 1·41 Proc. bei Rotweinen 1·55 Proc. Dieselben Verf. prüften verschiedene Methoden der Extractbestimmung und kommen zu dem Resultat, dass die Temperatur von 100° C. nicht überschritten werden darf, dass die Trocknung im Schwackhöfer'schen Trockenschrank bei 90—95° C. im Luftstrom die geeignetste ist und dass es sich empfiehlt, die indirecte Methode (Saccharometer-Anzeige des entgeisteten Weines) als Controle auch auszuführen (Weinlaube 1882, 279, 291 und 303). Kayser richtete sein Augenmerk besonders auf den Glycerinverlust bei der Bestimmung des Extractgehaltes durch Trocknen. Verf. fand, dass die Annahme Nessler's, dass 14 Proc. der Glycerinmenge verloren gehe, unrichtig sei, dass vielmehr der Glycerinverlust unabhängig von der Menge des vorhandenen Glycerins sei, dass die Grete'sche Methode*) den Glycerinverlust nicht vermeidet und bei der Methode von Magnier de la Source (Eintrocknen im Vacuum) auch nur ein geringer Teil des Glycerins verloren gehe, nicht alles, wie Nessler und Barth annehmen. Verf. glaubt, dass Eindunsten im Dampfbade und Trocknen bei 100° C. bis in gleichen Zeiträumen gleiche Verluste beobachtet werden, die beste Methode ist. Bei 10 cbcm Wein beträgt der Glycerinverlust etwa 0·012 g, d. h. an den gefundenen Extractprocenten fehlen 0·12. (Repert. f. analyt. Chemie 1882, No. 8.)

Musculus und Amthor fanden entgegen der sonst verbreiteten Ansicht gerade bei Weinen aus unreifen Trauben hohe Extract-, Aschen- und Phosporsäuregehalte. (Zeitschr. f. analyt. Chem. 1882, 194.)

Das Verhältnis von Glycerin zu Alkohol fand Borgmann übereinstimmend mit Nessler's und Barth's Angaben nie niedriger als 7·81:100, so dass ein Wein, dessen Gehalt an Glycerin zu Alkohol geringer als 7:100 ist, als mit Alkohol versetzt zu betrachten ist. (l. c. 58.)

Henninger fand in 1 l Wein etwa 0,5 g Glykol und zwar einem Butylglycol ($C^4H^{10}O^2$). (Compt. rend. 1882 XCV 94.)

Die Zuckerbestimmung in Mosten und Weinen hat Ulbricht in der weitgehendsten Weise auf ihre Fehlerquellen und Zuverlässigkeit geprüft und stellt auch eine Methode fest. (Landwirtsch. Versuchsstat. 1882 38, S. 77 u. 257.)

Bei Glycerinbestimmungen in Süssweinen erwärmen Nessler und Barth 50 cbcm Wein mit circa 10 g Sand und abgelöschtem Kalk im Wasserbade, fällen den gebildeten Zuckerkalk mit 96procentigem Alkohol aus, filtriren und behandeln den Abdampfrückstand nach der gewöhnlichen Methode. (Zeitschr. f. analyt. Chem. 1882, 159.)

*) Techn.-chem. Jahrb. 1883, S. 200.

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Eine neue Methode der Glycerinbestimmung schlägt Kayser vor, dieselbe basirt auf der Löslichkeit des Kupferoxyds in kalter alkalischer Glycerinlösung. 100 cbcm Wein werden mit 100 cbcm Kalilösung (50 Proc.) versetzt, Kupferlösung (200 g im Liter) zugesetzt, so lange sich das Kupferoxydhydrat noch löst, $^1/_2$ Stunde am Rückflusskühler erwärmt, Kupferlösung bis zu 100 cbcm Gesamtzusatz zugefügt, filtrirt, das Filtrat auf 1 l gebracht und darin (in 300—400 cbcm) das Kupfer bestimmt. Das Kupfer wird teils von Weinsäure (0·151 g Cu von 1 g), teils von Glycerin in Lösung erhalten. Von der Kupfermenge subtrahirt man die dem Weinsäuregehalt des Weines entsprechende Kupfermenge, aus dem Rest findet man das Glycerin nach der Angabe 1 g Kupfer = 1·834 g Glycerin. (Repert. f. analyt. Chem. 1882 No. 10 und 23.)

Eine Weinsteinbestimmung im Wein will Kayser nicht mehr ausgeführt wissen, da die nach der Berthelot-Fleurieu'schen Methode ausgeschiedene Weinsteinmenge auch das Kali des PO^4H^2K des Weines mit enthalten könne. Verfasser verlangt vielmehr zur Festsetzung eines Weinsäurezusatzes eine Bestimmung des Kali's und der Weinsäure (nach Nessler und Barth) und eine Berechnung, ob der Kaligehalt zur Bildung von Weinstein ausreicht oder zu gering ist. (Repert. f. analyt. Chem 1882, 150.)

Die Bestimmung des Weinsteins und der freien Weinsäure führen Nessler und Barth aus, indem sie 50 cbcm Wein eindampfen, mit 70proc. Alkohol schütteln, filtriren, im Rückstand den Weinstein mit Natronlauge titriren, das Filtrat entgeisten, mit 0·5 cbcm 20proc. Kaliumacetatlösung versetzen und den etwa gebildeten Weinstein wie vorher bestimmen. (Zeitschr. f. analyt. Chem. 1883, 159.)

Wartha endlich verkohlt 100 cbcm Wein in der Platinschale, verascht in der Muffel, löst in heissem Wasser, filtrirt und bestimmt die Alkalität mit $^1/_{10}$ Normalsalzsäure. 1 cbcm der letzteren entspricht 0·0188 g Weinstein. Die erhaltenen Zahlen fallen etwas höher aus, als nach der Berthelot-Fleurieu'schen Methode. (Weinl. 1882, 97.)

Claus bestätigt das Vorkommen von 0·01—0·05 Proc. freier Weinsäure in reinen Weinen schlechter Jahrgänge. Verf. hat seine Methode des Extrahirens der freien Weinsäure mit Aether dahin verändert, dass er mit absolutem Alkohol den bei 110° scharf getrockneten Weinextract auszieht. Weitere Versuche, namentlich über den Einfluss etwa vorhandener Kaliverbindungen flüchtiger Säuren auf das Ergebnis der Weinsäurebestimmungen sind in Arbeit. (Ber. d. chem. Ges. 1883, 1019.)

Den Gerb- und Farbstoffgehalt der Weine bestimmt Girard mit ölfreien Darmsaiten, deren Gewichtszunahme nach längerer Berührung mit einem bestimmten Volumen Wein, unter Berücksichtigung ihres Wassergehaltes, den Gehalt an jenen Weinbestandteilen angiebt. (Compt. rend. 1882, 95, 185.)

Zur Prüfung von weissen Tresterweinen auf hohen Gerbstoffgehalt wendet Nessler folgendes Verfahren an: 10 cbcm Wein werden mit Normal-

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lauge bis auf 5 Proc. der freien Säure abgestumpft, 1 cbcm 40proc. Natriumacetatlösung und tropfenweise 10proc. Eisenchloridlösung zugesetzt. Ein Tropfen fällt 0·5 Proc. Gerbstoff. Echte Weissweine färbten sich wenig, Tresterweine tief dunkel und gaben flockige Niederschläge. (Zeitschr. analyt. Chemie 1883, 159—171).

Gummizusatz zu Wein constatirt Nessler durch Eindampfen und Ausziehen von 100 cbcm Wein mit 90 Proc. Alkohol. Der Absatz wird abfiltrirt und beträgt bei Naturweinen 0·3—0·4 Proc., die sich bei Druck und 110° mit Salzsäure nicht verzuckern lassen, was bei Gummi- und Dextrinzusatz, die einen grösseren Rückstand geben, der Fall ist. (Zeitschr. analyt. Chemie 1883, 159—171.)

Den Phosphorsäuregehalt von 21 reinen 1881er Rheinweinen nach der Uranmethode fand J. Moritz zwischen 0·0140 und 0·0428 Proc. schwankend, bei vier reinen Frankenweinen zwischen 0·018—0·0313 Proc. (Chem. Ztg. VII, No. 17.)

Den Chlorgehalt von Weinen, welche nicht mit Kochsalz versetzt wurden (wie dies bei gefälschten stattfinden soll, um den Aschengehalt zu reguliren), fanden Nessler und Barth nie über 0·005 Proc. Die Methode, deren sich die Verfasser bedienen, ist folgende: 40—55 cbcm mit Tierkohle entfärbten Weines werden mit Salpetersäure angesäuert, mit titrirter Silberlösung im Ueberschuss versetzt und mit titrirter Rhodankaliumlösung zurücktitrirt, bis ein Tropfen mit verdünnter Eisenalaunlösung Rotfärbung zeigt. (Zeitschr. anal. Chem. 1882, 58.)

Borgmann fand in dem Weinbergsboden, der die besten Sherryweine trägt, nur 0·158 Proc. Schwefelsäure, während alte Angaben über deutsche Weinbergsböden 0·01—0·93 Proc. annehmen. Verf. glaubt daher, die Ansicht, dass der hohe Schwefelsäuregehalt weisser Sherryweine von der Bodenbeschaffenheit herrühre und nicht vom Gypsen, zurückweisen zu müssen (Ber. d. chem. Ges. 1883, 601).

In Mosten fand Kayser nicht über 0·020 Proc. Schwefelsäure. Verf. constatirt hiermit, dass die von ihm angegebene Grenze von 0·06 g SO^3 in 100 cbcm Wein eine bereits sehr hochgerückte und darüber hinausgehende Werte ein Gypsen bei Rotweinen, ein zu starkes Schwefeln bei Weissweinen mit Sicherheit anzeige. (Repert. anal. Chem. 1882, No. 5.)

Von 200 in Paris untersuchten Weinen waren nur 4 Proc. ungegypst, 17 Proc. hatten 3—6 g Kaliumsulfat im Liter. (Biedermann's Centralbl. f. Agriculturchemie 1882, 286.)

Nessler fand den Schwefelsäuregehalt des Weines unabhängig von der Traubensorte, wahrscheinlich schwankend nach der Bodenbeschaffenheit. In nicht eingebrannten oder gegypsten Weinen fand er nie über 1,3 Kaliumsulfat (= 0,6 g SO^3) im Liter. Verfasser stimmt aber dafür, auch bei uns die gesetzliche Grenze von 2 g im Liter, wie sie in Frankreich existirt, festzustellen, da ein geringes Gypsen ohne Nachteil sei. (Weinbau 1882, 27.)

Um schnell näherungsweise den Schwefelsäuregehalt im Wein zu be-

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stimmen, misst E. Houdard 5mal 5 cbcm des Weines ab, versetzt mit 0,5—1,0—1,5 etc. — 2,5 cbcm einer Barytlösung (14 g $BaCl^2$ + 50 cbcm HCl in 1 l Wasser), von der 10 cbcm = 0,1 g Kaliumsulfat entsprechen, kocht auf, filtrirt und prüft, bei welcher Probe noch Trübung im Filtrat mit der Literflüssigkeit eintritt. (Ber. chem. Ges. 1882, 264.)

Nach Carles findet Entgypsen von Weinen mit Bariumsalzen statt. Eine solche Manipulation ist noch gefährlicher als das Gypsen, da nie die Schwefelsäure ganz genau gefällt werden kann, leicht überschüssiges Barytsalz in den Wein gelangt und auch der schwefelsaure Baryt sich so fest in die Fasswandungen setzt, dass er sehr schwer zu entfernen ist. (Pharm. Centralh. 1882, 442.)

Kayser fand durch Versuche, dass der Thonerdegehalt des Weines, der mit Kaolin geschönt wurde, abhängig ist von der Säuremenge und der Temperatur und auf 0,035 g Al^2O^3 in 100 cbcm steigen kann. Aus einem Gehalt von 0,3—0,4 g Thonerde im Liter auf Alaunzusatz zu schliessen ist also nicht zulässig. (Repertor. f. analyt. Chemie 1882, 16.)

Ostermayer fand in reinen Weinen den Mangangehalt zu 4—5 mg schwefelsaurem Mangan im Liter. (Weinlaube 1882, 260.)

S. Kitiesan wies in den Destillaten alter, fertiger Weine quantitativ Ammoniak nach, bis zu 0,0142 Proc., und in einigen auch Ameisensäure. Aus letzterem Grunde verwirft Verfasser die Wartha'sche Methode des Nachweises der schwefligen Säure im Wein durch Einleiten des Destillates in Silberlösung, da die entstehenden weissen Niederschläge selbst neben schwefliger Säure noch organische Substanzen enthalten. (Ber. chem. Ges. 1883, 1179.)

R. Förster fand in Bier, Wein und anderen gegohrenen Flüssigkeiten Furfurol, welches er als ein Product des Lagerns anspricht. (Weinbau 1882, 89.)

Zur annähernden Bestimmung der Salicylsäure in Weinen giebt Rémont eine auf Vergleich mit der Farbenintensität einer Normallösung beruhende Methode an. (Compt. rend. 1882, XCV. 786.)

Schwefelwasserstoff im Wein (von abgetropftem Schwefel herrührend) weist Liebermann im Destillat mit alkalischer Nitroprussidnatriumlösung nach.

Pastrovich fand die Methode des Fuchsinnachweises mit Braunstein, wobei nur fuchsinhaltiger Wein nicht entfärbt wird, zutreffend. (Ber. d. deutsch. chem. Ges. 1882, 808.) Die Stearinreaction auf Fuchsin modificirt C. H. Wolff dahin, dass er die fuchsinhaltende Stearinschicht abhebt und in Amylalkohol löst. (Repert. f. analyt. Chemie 1882, 193.)

Maumené fand, dass der Farbstoff der Trauben, das Oenocyanin, anfangs farblos ist, und erst in Folge eines Oxydationsprocesses schnell gefärbt erscheint. Grüne Trauben (dicht vor der Reifeperiode) in der Luftpumpe getrocknet, wurden sofort blau gefärbt, wenn Verfasser Luft und Feuchtigkeit einströmen liess. (Compt. rend. 1882, XCV, 924.)

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4. Rückstände und ihre Verwertung.

Auf die Verwertung gewaschener und auf 60—100° erwärmter Traubenhülsen zur Erzeugung von gegohrenen Getränken z. B. Champagnerbier hat Reihlen das D. P. 17943 erhalten. Ein Verfahren, den Trestern den Farbstoff mit Sprit und Weinsäure zur Gewinnung eines Weinfärbemittels zu entziehen, giebt Cencelli an. (Weinlaube 1882, 559.) Carles teilt als Methode, in Hefe, Trestern etc., welche neben Weinstein, Kalktartrat enthalten, den Gehalt an letzterem zu bestimmen, mit, dass man in überschüssiger Salzsäure löst, mit Ammoniak übersättigt, mit dem doppelten Volum 90proc. Alkohols versetzt und den Niederschlag als Kalktartrat bestimmt. (Pharm. Centralh. 1882, 323.)

Mach bringt interessante Mitteilungen und Analysen von Cognacs. Der Oenanthäther ist keineswegs ein wesentlicher Bestandteil der feinen Cognacs, dagegen in grosser Menge in den Tresterbranntweinen enthalten. (Weinlaube 1882, 342.)

Statistik.

Deutsches Reich. Nach Angaben von Dilthey producirt Deutschland durchschnittlich 2 600 000 hl Wein mit einem Durchschnittspreise von 50 M. per Hektoliter. Der Handelswert der deutschen Weine wird zu 265 Millionen Mark angegeben. Davon entfällt auf den eigentlichen Rheingau in den letzten 7 Jahren eine Ernte von durchschnittlich 45 120 hl Wein. (Weinbau 1882, 113.)

Eine Zusammenstellung des Aussenhandels geistiger Getränke des Deutschen Reiches 1879 und 1880 mit Bezug auf Oesterreich-Ungarn findet sich in der Weinlaube 1882, 284.

Aus den Berichten über die Weinerträge des Regierungsbezirkes Wiesbaden (Rheingau) mag hier hervorgehoben werden: Es wurden vom Hektar durchschnittlich geerntet

	1880	1881
weisser Wein hl.	4,9	23,1
roter „ „	3,6	20,2
überhaupt . .	4,9	23,5

Gekeltert wurden: 1881 von weissen Trauben 65·64 780 hl.
1875—1881 durchschnittlich . . 55·51 151 „
1881 von roten Trauben . 1·04 160 „
1878—1881 durchschnittlich . . 1·84 144 „

Das Jahr 1875 war das beste, 1879 das schlechteste (Weinlaube 1882, 185).

Die Weinernte Württembergs wird wie folgt angegeben:

	Hektar		Hektoliter	
	1880	1881	1880	1881
Oberes Neckarthal	1 316	1 299	13 560	36 996
Unteres „	8 589	8 627	53 212	200 422

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	Hektar		Hektoliter	
	1880	1881	1880	1881
Remsthal	1 896	1 906	4 626	61 785
Enzthal	1 536	1 521	3 289	19 976
Zabergäu	1 393	1 413	5 904	26 213
Kocher und Jagstthal . . .	1 666	1 655	8 921	30 719
Taubergrund	1 737	1 740	4 781	16 709
Bodenseegegend	268	262	2 330	6 155

(Weinlaube 1882, 142.)

Die Weinproduction des Elsass im Jahre 1881 wird zu 750 000 hl angegeben. (Weinbau 1882, 37.)

Im Deutschen Reich betrug, in metrischen Centnern ausgedrückt, die

Waarengattung	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an Wein und Most in Fässern	509 227	530 401	104 571	115 106
„ Schaumwein in Flaschen . .	30 523	30 939	13 762	13 543
„ anderem Wein in Flaschen	8 338	8 400	48 406	46 983

Oesterreich-Ungarn. Nach den Ernteausweisen des k. k. Ackerbauministeriums belief sich die Weinernte 1881 auf:

Steiermark	280 000	= 62	Proc.,
Kärnten	1 500	= 238	„
Krain	174 000	= 101	„
Tirol und Vorarlberg	420 000	= 121	„
Mähren	120 000	= 57	„
Görz und Triest . .	88 000	= 86	„

wenn die zehnjährige Durchschnittsernte = 100 gesetzt wird.

(Niederösterreich, Dalmatien und Istrien sind nicht angegeben.)
(Weinlaube 1882, 105.)

Tabellen über Ein- und Ausfuhr von Wein und einschlägigen Artikeln des österr. ungar. Zollgebietes im Jahre 1881 gegenüber den Ergebnissen im Jahre 1880 sind in der Weinlaube 1882, 129 mitgeteilt.

Nach Publikationen des ungarischen statistischen Büreaus wurden 1880 auf 362 233 Hektaren an Most 2 696 438 hl gewonnen, der sich verteilt auf Wein:

weisser	1 287 923 hl
rother	364 123 „
Schiller	459 488 „
Ausbruch . . .	10 565 „
aus gekauftem Most	304 740 „
Traubenhandel nach dem Auslande	1 066 060 kg
nach dem Inlande .	2 915 159 „

Nach 1874 war 1880 das schlechteste der letzten 20 Jahre (Weinlaube 1882, 513).

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Dalmatien, dessen Weinproduction sich hebt, erntete

1879	502 654 hl.
1880	1 400 916 „
1881	1 486 488 „

der mittlere Export betrug 156 267 hl. (Weinlaube 1882, 573.)

Ueber Weinhandel zwischen Oesterreich-Ungarn und der Schweiz siehe Weinlaube 1882, 597.

Serbien. Der Aussenhandel mit geistigen Getränken ist tabellarisch zusammengestellt (Weinlaube 1882, 596).

Frankreich. Das französische Ackerbauministerium giebt die Weinernte des Jahres 1881 auf 35 577 689 hl an. Durch Zuckeraufguss wurden ca. 2 Mill. Hektoliter Tresterwein, und ferner 2 400 000 hl Rosinenwein gemacht. (Weinlaube 1882, 609.)

Holland:	1879	1880	1881
Einfuhr: Wein in Gebinden	25 573 000	26 645 000	25 488 000
„ „ Flaschen	10 074 000	11 431 000	9 607 000
Ausfuhr: „ „ Gebinden	9 551 000	12 168 000	10 540 000
„ „ Flaschen	9 204 000	10 451 000	9 364 000

(Weinlaube 1882, 597.)

Spanien: Einfuhr: Wein 678 320 kg,

Ausfuhr:		
gewöhnlicher Wein	Liter	635 233 295
Xeres	„	26 247 478
feiner Wein	„	15 789 907

(Weinlaube 1882, 621.)

Grossbritannien verbrauchte 1881 = 15 644 757 Gallonen fremder Weine. (Weinlaube 1882, 369.)

Russland: Import:		1879	1880	1881
Wein in Gebinden . . .	Pud	899 461	1 151 939	692 779
„ „ Flaschen	Stück	259 008	386 573	259 891
Champagner	Flaschen	749 639	1 099 305	365 652

(Weinlaube 1882, 273 und 561.)

Madeira: Die Weinerträge von Madeira werden von 1861 bis 1881 mitgeteilt, letztere war 39 240 hl.
(Weinlaube 1882, 188.)

Nord-Amerika: Einfuhr im Fiscaljahre 1881 (endend 30. Juni):

Wein in Fässern	Gallonen	4 370 947
„ „ Flaschen	Dutzend	457 257

(Weinlaube 1882, 609.)

O. Saare.

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XXIV. Bier.

I. Rohmaterialien.

Karl Lintner berichtet (Zeitschr. f. d. ges. Brauwesen 1883, S. 5) über eine grössere Anzahl von Analysen von Brauwässern und bestätigt abermals, dass die meisten derselben mehr oder minder hart sind und diese Eigenschaft für Wasser zu Mälzerei- und Brauereizwecken in gewissen Grenzen gute Folgen hat. Besonders sei ein gipshaltiges Wasser sehr beliebt, und Brauereien, die solches Wasser benutzen, haben am wenigsten über trübe Würzen, trübe Biere und schlechte Hefe zu klagen.

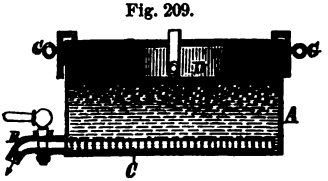
Ueber die Cultur der Braugerste schreibt E. Pott in d. Allg. Brauer- und Hopfen-Ztg. 1883, 39—48.

Die Beurteilung des Hopfens als Braumaterial von Braungart, siehe Zeitschr. f. d. ges. Brauwesen 1882, 425 und folgende.

Nach dem „Bierbrauer" 1882, No. 20, S. 492 wird als gutes Conservirungsmittel des Hopfens 80 proc. Alkohol empfohlen. Der alkoholisirte Hopfen verlangt, um nicht wieder seiner Vorzüge verlustig zu gehen, ein vollkommen dichte und festgepresste Packung, so dass sich also das Alkoholisiren in doppelter Beziehung vorteilhaft erweist.

O. Lenz in Berlin reinigt Hopfen mittelst Waschens folgendermassen: (D. P. 18168 vom 21. Oct. 1881.) In den Bottich *A* wird so viel Wasser geschüttet, dass das perforirte Rohr *C* bedeckt ist. Darauf wird Hopfen in einer Schicht von ca. 15 cm in den Bottich eingebracht. Sodann setzt man den Deckel *D* auf und schraubt die Stellschrauben *G* da ein, wo das Aufsteigen des Deckels begrenzt werden soll. Hierauf wird laues Wasser zugegossen, bis der Deckel unter Wasser steht. Nachdem der Hopfen ca. 12 Stunden angewässert ist, wird das Wasser durch den Hahn *B* abgelassen.

Fig. 209.



II. Mälzerei.

A. Steinecker hat ein System (Zeitschr. f. d. ges. Brauwesen 1883, S. 7) zum Weichen und Waschen der Gerste zusammengestellt. Das System besteht aus zwei Weichstöcken, von denen der eine im Weichraum oder höher, der andere in der Tonne hängend angebracht ist; sie sind mit einer Waschmaschine derart combinirt, dass die Gerste während der Entleerung aus dem ersten in den zweiten Stock gewaschen wird.

Da die durch Gegenströmung und Reibung wirkende Waschvorrichtung die Gerste von Schmutz und Schleim gründlich reinigt und der Luftzutritt gleichmässig wirkt, so wird die Weichezeit um etwa die Hälfte verkürzt.

Die Malzdarre von Ulrich, sog. Einhordensystem, hat sich nach Be-

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obachtungen von Louis Aubry (Zeitschr. f. d. ges. Brauwesen 1883 S. 125) vorzüglich bewährt. Das Princip dieser Darre ist die Trennung der Schwelkhorde von der Darrhorde, welche bei den gewöhnlichen Darren übereinander liegen, und deren Anbringung in zwei selbstständig zu ventilirenden und zu heizenden Räumen. Die Temperaturen auf beiden Darren nehmen bei den angestellten Versuchen ausserordentlich gleichmässig zu und konnte bei einer Maximaltemperatur auf der Schwelkhorde von 32° R. im Malze eine Abdarrtemperatur von 83° im Malze der Darrhorde erreicht werden. Die sämmtlichen Darrmalze waren sehr mürbe und gaben ausserordentlich feine Würzen von goldgelber Farbe. Das Verhalten der Malze beim Sudprocesse, die Gärungen und die gewonnenen Biere bestätigten die guten Eigenschaften des Malzes in schönster Weise.

In No. 15—18 1882 des „Böhmischen Bierbrauer" bekämpft, weist Schneider nach, dass die lange Einwirkung einer hohen Temperatur auf ein Malz direct schädlich werden kann und plaidirt für eine Abdarrtemperatur von 60—66° R.

Nach Th. Langer ist bei der Wertbestimmung des Malzes Rücksicht zu nehmen 1. auf die äusseren Eigenschaften desselben unter Rückschluss auf die Qualität der vermälzten Gerste und auf die Behandlung derselben in der Mälzerei; 2. auf die Extractausbeute des Malzes im kleinen unter Rückschluss auf die im Sudhause im günstigsten Falle erzielbare Ausbeute; 3. auf die Zeit, welche zur vollständigen Umwandlung der Stärke in Maltose und Dextrin nach erreichter Abmaischtemperatur von 70° C. verstreichen musste; 4. auf Farbe und Durchsichtigkeit der Würze und auf die Schnelligkeit des Ablaufens derselben von den Trebern; 5. auf den Gehalt des Extractes der Würze an Maltose und auf das in dem Extracte auftretende Verhältnis zwischen Zucker (als Dextrose gerechnet) zu Nichtzucker. (Allgem. Ztschr. f. Bierbr. u. Malzfabr. 1883, S. 309.)

Hinsichtlich der stickstoffhaltigen Bestandteile des Würzeextractes begnügt man sich zur Zeit mit der Bestimmung des Gesamtstickstoffes, eine Trennung dieser Körper in Eiweiskörper, Peptone und Amide und eine quantitative Bestimmung der einzelnen Körpergruppen, um das Mengenverhältnis derselben von Fall zu Fall kennen zu lernen, wird in jüngster Zeit genauer studirt. Nach F. Ullik ist vorderhand folgendes beobachtet:

1. Normales Malz enthält keine fertig gebildeten Peptone, die Hauptmenge des Stickstoffs der wasserlöslichen Stickstoffverbindungen entfällt auf die amidartigen Substanzen.

2. Es dürfte vorkommen, dass unter besonderen Umständen bei der Bereitung oder Aufbewahrung des Malzes sehr geringe Peptonmengen im Malze auftreten.

3. Eigentliche Peptonbildung erfolgt erst bei der Bereitung der Würze; die Menge der Peptone ist aber verhältnismässig nicht sehr bedeutend und steht weit zurück hinter derjenigen der amidartigen Substanzen.

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4. Die Verteilung des Stickstoffes auf die einzelnen Gruppen der stickstoffhaltigen Substanzen scheint je nach der Beschaffenheit des Malzes eine sehr verschiedene zu sein.

Die Grenzen, innerhalb welcher Extract- und Zuckerausbeuten in den im Jahre 1882 von Langer untersuchten Malzen hervorragenden Brauereien und Mälzereien sehwankten, ergeben sich aus folgenden Zahlen:

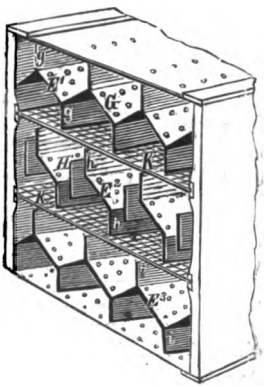
Höchster Wassergehalt . . .	13·51 Proc.
Niedrigster „ . . .	4·20 „
Längste Verzuckerungszeit . .	75 Minuten
Kürzeste „ . .	10 „
Höchste Extract-Ausbeute aus Malztrockensubstanz . . .	82·29 Proc.
Niedrigste Extract-Ausbeute aus Malztrockensubstanz . . .	76·17 „
Höchste Zuckerausbeute . .	72·91 „ Maltose
Niedrigste „ . . .	63·68 „ „
Günstigstes Verhältnis	Z : NZ = 1 : 1·05
Ungünstigstes „	Z : NZ = 1 : 1·36

Nach C. Lintner soll sich das Verhältnis Z : NZ zwischen 1 : 1·2 und 1 : 1·3 bewegen.

Bei der Malzeinrichtung von W. F. Howe in Chicago (D. P. 22132 vom 2. Juni 1882) findet das Keimen des Getreides und das Darren des aus ihm entstandenen Malzes in einem um seine Achse drehbaren, transportablen Behälter statt, welcher aus einer Reihe kleinerer Abteilungen besteht. Letztere werden gebildet durch um Scharnier bewegliche Scheidewände E^1 E^2, die in einer Ebene liegen (Fig. 210) oder im Zickzack verlaufen (Fig. 211) und durch welche beim Füllen das Getreide aus einer in die nächste Abteilung fällt, ferner durch senkrechte Wände *g h i* und Siebe *K K*, welche ein Zusammenbacken der Körnermasse zu Kuchen verhindern. Im Deckel, im Boden und in den Scheidewänden sind Luftlöcher angebracht. Der Apparat kann auch mittelst einer Friction srollenanlage gedreht werden. Das Getreide bezw. Malz bleibt beständig in demselben Apparate, welcher auf Schienengeleisen die verschiedenen Mälzereiräume, die Keimkammer, die Kühlkammer und die Darre durchläuft. Die einfach construirte Darre besitzt eine über dem Herde angebrachte verstellbare Kappe zur Regelung der Wärmezufuhr.

Fig. 210.

Fig. 211.



Bei der Darranlage von Witschel in Breslau (D. P. 17977 vom 25. Mai 1881) lagert das bei *a* eingefüllte Material sich im Raume *c* um die Heizrohre *s s*, durch welche die im Heizraum *h* erzeugte heisse Luft circulirt. Die Rohre haben einen herzförmigen Querschnitt und sind so an-

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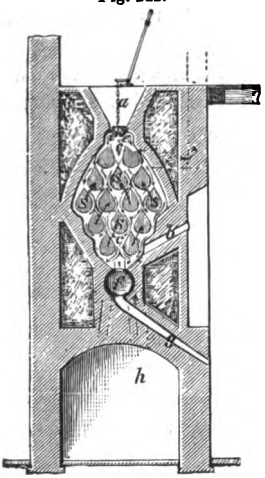
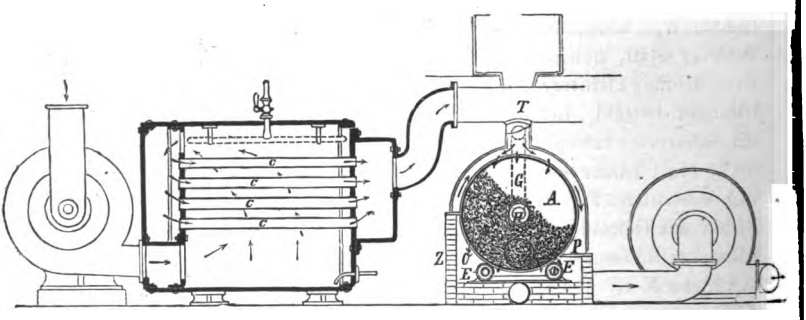
Fig. 212.



geordnet, dass die Producte bei dem Gange durch den Darrraum sich von selber wenden. Um den sich entwickelnden Gasen einen Abzug zu geben, sind die Rohre auf der Unterseite aus geschlitztem Blech gefertigt, durch welches der Wrasen eingesogen und nach dem Wrasenabzug *x* geführt wird. Der Darrraum wird oben durch die Klappen *e e*, unten durch die drehbare Trommel *f*, mittelst welcher man den Abfluss des getrockneten Productes durch den Canal *g* reguliren kann, geschlossen. Zur Beobachtung des Processes im Raume *c* dient die Eingriffföffnung *b*.

Der Mälz- oder Darrapparat von Golay in Paris (D. P. 17953 vom 24. Juni 1881) besteht aus dem von ganz oder teilweise durchlochtem Blech hergestellten Cylinder *A*, welcher mit einer Centralröhre *H* versehen ist. Der Cylinder rotirt in einem von der äusseren Luft abgeschlossenen Raum, welcher durch die Wände *P* geteilt ist. Die zum Mälzen oder Darren erforderliche Luft wird durch die Rohre *T G H* in den Cylinder

Fig. 213.



eingetrieben. Das Rohr *T* erhält die Luft aus einem Behälter, in welchem eine Anzahl aus gebrannter poröser Erde gefertigter Rohre *C* angebracht ist, die von einem Giessapparat benetzt werden. Die Kühlung der Luft erfolgt dadurch, dass sie zuerst über die Rohre und darauf durch dieselben getrieben wird.

Ein Malzapparat von Reynolds in Chicago (D. P. 17932 vom 16. Aug. 1881) besteht aus einer äusseren, runden Hülle *A* und einem hohlen Mittelpfeiler *B*, an welchem in gewissen Abständen Laufrollen *CC*$_1$ in passenden Lagern angebracht sind. Von diesen Rollen werden die einzelnen Keimböden drehbar unterstützt. Diese bestehen aus einer Reihe von Platten, welche Teile einer Kreisfläche bilden und mittelst Zapfen zwischen zwei concentrischen Reifen *FF* drehbar angebracht sind. Die Löcher, in welchen die

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Zapfen ruhen, gehen in verticale, nach oben frei liegende Nuthen aus, so dass das Herausnehmen der einzelnen Platten möglich ist. Letztere sind an ihrem unteren Teile durch Oesen *G* und Hakenstangen *H* in mehr oder weniger grosser Anzahl mit einander verbunden und können dadurch gemeinschaftlich umgekehrt werden. Der hohle Pfeiler *B* steht an seinem oberen Ende mit einem Ofen und einem Luftaspirator, an seinem unteren Teile mit einem Ventilator und einem Luftfeucht-Apparat in Verbindung. Ueber jedem Keimboden sind abwechselnd in der äusseren Hülle und in dem Mittelpfeiler Lufthöcher derartig angebracht, dass ein von aussen nach dem Pfeiler oder in umgekehrter Weise erzeugter Luftzug stets durch die zwischen den einzelnen Platten gelassenen Spalten dringen muss.

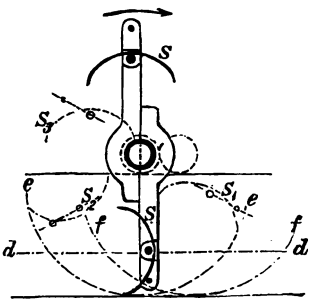
Fig. 214.

Suck in London hat einen Apparat zur „Gelatinisirung" von ungemalztem Getreide construirt. (D. P. 19535 vom 14. Februar 1882.) Eine senkrechte hohle Welle in einem geschlossenen Gefäss ist an ihrem unteren Ende mit durchlochten Armen versehen. Durch die hohle Welle strömt Dampf, welcher beim Austritt aus den Oeffnungen der horizontalen Arme die Welle nebst diesen Armen in Drehung versetzt. Der rückwärts und nach unten ausströmende Dampf bewirkt das Kochen des Getreides und dessen Gelatinisirung.

Puvrez-Bourgeois in Lille bildet den Lüftungsboden aus hölzernen, mit trapezförmigen Schlitzen versehenen Horden (D. P. 18159).

Der wie gewöhnlich mittelst Schnecke und Schneckenrad auf Zahnstangenbahnen zu beiden Seiten der Darrhorden sich fortbewegende Malzwender von Pickart in Schweinfurt (D. P. 21360 vom 7. Februar 1882) besteht aus einer Reihe von Haspeln, welche auf einer hohlen Welle befestigt und durch vier horizontale Rundeisenstangen *a* und *b* verbunden sind. Letztere bilden die Drehachsen für die cylindrisch gebogenen Blechschaufeln *S*. Der Schwerpunkt derselben liegt in ihrer Höhlung und unter ihrer Drehachse. Bewegt sich nun die Schaufel mit dem Haspel in Richtung des Pfeiles, so wird sie nach einer Vierteldrehung von der Stange erfasst, welche ihr eine feste Stellung zu den Armen giebt, tritt in der Linie *d* in das Malz ein, in dem sie mit ihrer äusseren Kante die Curve *ee* beschreibt, schiebt das Malz vorwärts und nimmt beim Austritt aus demselben einen Teil mit in die Höhe, um darauf in Stellung S_3 in Folge der Aenderung der Lage des Schwerpunktes plötzlich umkippend ihren Inhalt in das durch die Schaufel geschaffene Thal zu entleeren. Die Curve *ff* stellt den Weg der äusseren Kante der nächstfolgenden Schaufel dar. Bei ent-

Fig. 215.



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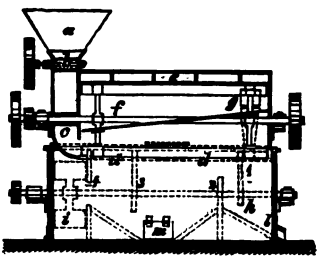
gegengesetzter Bewegung des Haspels bleibt die Fähigkeit der Schaufeln ganz dieselbe.

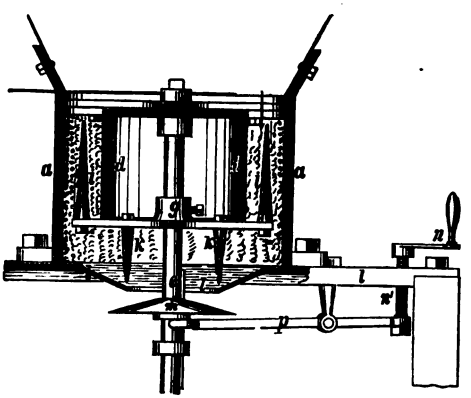
Bei der Malzschälmaschine von Rössler in Altenmarkt (D. P. 20794 vom 31. Mai 1882) wird das Malz in den Einleertrichter *a* gebracht und durch die Speisewalze *b* in den Canal *c* geführt; dort sammelt sich dasselbe auf dem Stahldrahtnetz an, wird von den Schlagflügeln gefasst und an den Stahldraht und Anschlagflächen *d* und *e* von der Haut befreit und gegen das andere Ende fortgeführt, wo dasselbe durch das Rohr *g* in den Raum *h* fällt. Da nun der Windflügel durch die Oeffnung bei *l* Luft ansaugt, so werden die leichteren Teilchen und der anhängende Staub, welche mit dem Malz durch das Rohr in den Raum *h* abfallen, mit dem Wind nach dem Ventilator *i* durch die Oeffnungen der Bretter *1*, *2*, *3* angezogen, und das schwere Malz fällt direct durch die Oeffnung *l*, der Staub folgt dem Ventilator, während die abgestossenen Häute an den Wänden *3* und *4* zu Boden fallen und durch die Klappe *m* herausgenommen werden.

Fig. 216.



Die Entkeimvorrichtung von Bachmann in Kleinsorheim (D. P. 20290 vom 24. März 1882) besteht aus den beiden mit Raspelblech bekleideten Cylindern *a* und *d*, zwischen welchen sich die Raspeleisen *i* und unterhalb des Cylinders *d* die Raspeleisen *k* durch Vermittelung des Drehkreuzes *g* bezw. der Achse *e* drehen. Hiermit steht die Platte *l* in Verbindung. Eine Vorrichtung zur Regulirung des Malzauslaufes während der Drehung der Achse *e* besteht aus der dachförmigen Abschlussplatte *m*, dem Hebel *p* und der Kurbel *n* mit Schraube n^1. Diese Getreideputzmaschine lässt sich durch beliebiges Hinzufügen der Abreibvorrichtung nebst Abschlussplatte *m* in eine Malzputzmaschine umgestalten.

Fig. 217.



Nach L. Chiozza (D. P. 19634 vom 17. Januar 1882) wird Mais behufs Trennung der Hülsen und Keime in heissem Wasser oder in einer schwachen Lösung von schwefliger Säure eingeweicht und darauf zwischen Walzen gequetscht. Auf einem Schüttelsiebe werden dann Kleber und Stärkemehl mit Hilfe von Wasser getrennt und die zurückbleibenden Keime und Hülsen da-

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durch gesondert erhalten, dass man sie in eine Zuckerlösung von 10—12° B. bringt, in welcher die Hülsen zu Boden sinken, während die Keime durch Abschöpfen gewonnen werden. Letztere werden getrocknet, gemahlen und geröstet. Mit den Hülsen wird ebenso verfahren. Zur Herstellung eines Genussmittels werden die gerösteten Keime und Hülsen in passendem Verhältnis mit einander gemischt. Zur Erhöhung des Aroma kann man vor dem Rösten eine Lösung von Tannin in Methylalkohol zusetzen, ebenso Zucker, Traubenzucker oder Caramel.

Schäffer in Breslau versieht die Mälzerschuhe mit Bürstensohlen (D. P. 16944).

3. Brauen.

Nach der Zeitschr. f. d. ges. Brauwesen 1882, S. 221 finden sich in den Anschwänzwürzen reichlich stickstoffhaltige und Aschebestandteile, und zwar ist deren Menge im Verhältnis zur Concentration grösser als in den Vorderwürzen. Es wird nicht nur das in den Trebern steckende, beim Maischprocess entstandene Extract ausgewaschen, sondern auch ein Teil der noch nicht gelösten Bestandteile der Trebersubstanz in Lösung gebracht. Dieses Auswaschen scheint sich besonders ergiebig auf die vorhandenen Salze zu erstrecken. Temperatur und Quantum des Anschwänzwassers werden hier wesentlich bei dem Auswaschen mitspielen; das Anschwänzen bedingt also eine Erhöhung der Ausbeute sowie Vermehrung der Hefenährstoffe in der Würze. Bei der Gährung verschwinden die Zuckermengen und Hefenährstoffe; nach vollendeter Hauptgährung enthalten die Biere viel geringere Mengen Stickstoff, Hand in Hand gehend mit der Hefevermehrung; bei der Nachgärung verschwindet nunmehr wenig Stickstoff; beim längeren Lagern fand Grimmer unter Umständen wieder eine Zunahme des Stickstoffs, weil die Hefe wieder an das Bier durch Exosmose stickstoffhaltige Bestandteile abgiebt. Bei einer gewissen Lagerzeit, und wenn die Hefe normal beschaffen war und nicht Neigung zur Zersetzung hatte, scheint die Abnahme des Stickstoffgehaltes aufzuhören, aber auch keine Zunahme mehr stattzufinden. Das letztere möchte vielleicht ein Kennzeichen einer Lagerung unter gesunden Verhältnissen sein.

Das Kessel- oder Pfannenmaischen, eine Combination zwischen dem Infusions- und Decoctionsverfahren, empfiehlt Jeschek (l. c. 65). Das Verfahren ist folgendes: Der Kessel wird mit Wasser gefüllt und dieses bis zum Kochen erhitzt. Hierauf wird etwas über die Hälfte des heissen Wassers abgelassen (zum Reinigen der Fässer etc.). Durch Zugabe von kaltem Wasser wird die Temperatur auf 40—42° C. herabgedrückt. Das Malzschrot wird nunmehr eingeteigt, wodurch die Temperatur auf 38—40° sinkt.

Unter stetem Umrühren wird diese Temperatur eine halbe Stunde lang eingehalten. In der zweiten halben Stunde wird die Maische durch ein sehr gelindes Feuer um 6°, somit auf ungefähr 45° erhöht. Die Temperaturerhöhung um weitere 15° in der dritten halben Stunde wird rascher bewerk-

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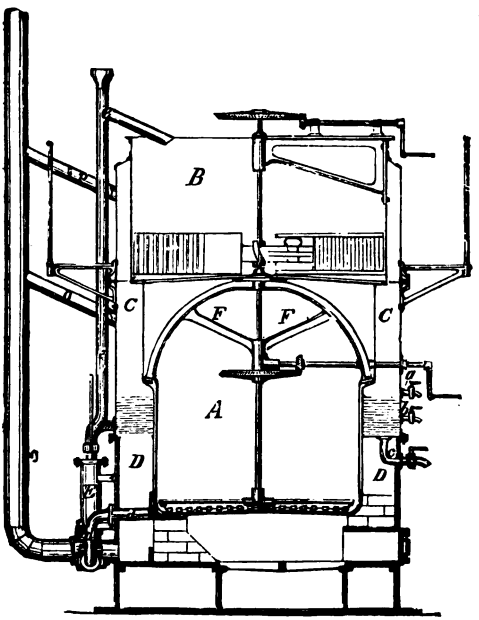
stelligt, um die für die Milchsäurebildung günstige Temperatur schnell zu überspringen. Nachdem die Temperatur rasch auf 60° gebracht ist, wird diese eine Stunde lang belassen. Sodann wird die halbe Maische in den Läuterbottich gebracht und die andere Hälfte eine halbe Stunde lang unter tüchtigem Umrühren gekocht. Die gekochte Maische wird bei fortwährendem Umrühren in den Läuterbottich gepumpt oder abgelassen.

Hierdurch wird die gesamte Maische auf die (Abmaisch-) Temperatur von 75° gebracht. Nach einstündiger Ruhe wird abgeläutert.

Um Reis mit Vorteil zum Brauen zu verwenden, wird derselbe nach Anton Markl (Biedermann's Centralbl. f. Agric.-Chem. 1883, S. 348) als Mehl in siedendes Wasser gebracht und unter beständigem Umrühren verkleistert. Das Verkleistern kann man auch zweckmässig vermittelst Einströmenlassen von Dampf in das Gemenge von Reismehl und Wasser bewerkstelligen, und genügt ein hölzerner Bottich, welcher über der Pfanne aufzustellen ist. Die Hälfte dieses Reiskleisters setzt man, sobald der erste Dickmaisch in der Pfanne sich befindet, diesem unter Umrühren zu, erwärmt langsam die Maische auf 55° R., lässt $^1/_2$—$^3/_4$ Stunde dabei stehen und erhitzt darauf zum Kochen; die zweite Hälfte des Reiskleisters bringt man in ganz gleicher Weise zur Dickmaische. Reisbierwürzen können stärker gehopft werden, da der Zusatz von Reis einen süsseren Geschmack verursacht. Um eine normale Gährung zu erzielen, müssen die Würzen kühl gehalten werden. Die Reisbiere selbst müssen möglichst kalt gefasst und bei niedriger Kellertemperatur gelagert werden.

Fig. 218.



Joh. Möller in Mindelheim. Brauapparat. (D. P. 20675 vom 16. Mai 1882.) Der Maischkessel *B* wird mit Malz und Wasser gefüllt, aus dem Kessel *A* wird mittelst der Dickmaischpumpe *E* und der Röhren *d* und *e* heisses Wasser progressiv nach bestimmten Wärmegraden in den Maischkessel aufgepumpt und das beliebig construirte Rührwerk in demselben in Bewegung gesetzt. Hierauf lässt man einen Teil der Maische durch den am Boden des Maischkessels befestigten und in den Kessel *A* mündenden Ablaufhahn

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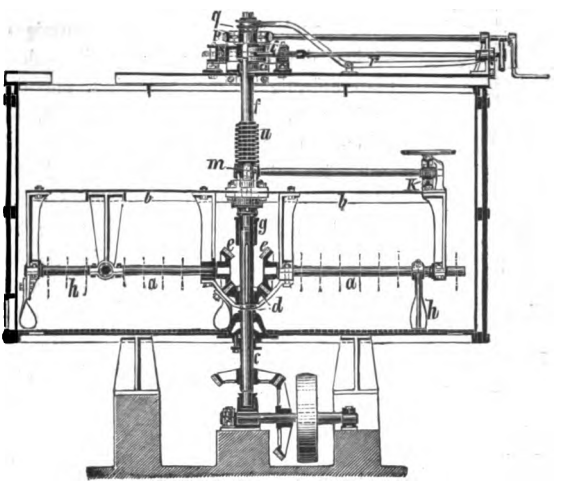
f in den Kessel *A* laufen, pumpt die Maische mittelst der Pumpe *E* und der Rohre *d* und *e* wieder in den Maischkessel hinauf und wiederholt diese beiden Vorgänge bis zum Ausscheiden der Würze, so dass schliesslich das ganze Quantum Malz und Wasser sich in dem Maischkessel *B* befindet. Nach gehöriger Ruhe wird die Würze durch den dreiteiligen Hahn *g*, der sich an dem innerhalb des Braukessels am Maischkesselboden befestigten Rohr *h* befindet, abgelassen, worauf dieselbe durch den durchlöcherten, schrägen Senkboden *i*, der mit einem am Rande angenieteten Ring auf dem vertieften Maischkesselboden ruht, entströmt, an dem Hahn *g* aufgefangen und wieder in den Maischkessel *B* zurückgeschüttet wird. Nachdem der Hahn *g* zum Zwecke des Abläuterns der Würze wiederholt geöffnet worden ist, wird er, sobald die anfänglich teigige Würze klar und rein ausläuft, sofort umgestellt, worauf letztere durch das Rohr *l* in den Kessel *A* fliesst. Nachdem diese Abläuterung sich vollzogen hat, wird die Maische mit einem entsprechenden Quantum Warmwasser aus dem Vorwärmer *c* durch Aufpumpen mittelst der Pumpe *E* und der Rohre *m* und *e* übergossen und nach einiger Ruhe wieder durch den Hahn *f* in den Kessel *A* abgelassen, worauf das an dessen Aussenseite befindliche Treberventil *n* geöffnet wird, wobei zugleich die Entfernung der Treber durch Einsatz einer Röhre oder Transportschnecke gefördert werden kann. Die Dämpfe aus dem Braukessel *A* und dem Vorwärmer *C* treten durch die Rohre *o* und *p* in den Rauchkamin aus.

Die Universal-Maisch- und Aufhackmaschine von Lipps in Dresden (D. P. 18342 vom 30. October 1881) besitzt zwei liegende Rührwellen *aa*, die in den an der Traverse *b* befestigten Hängearmen gelagert sind. Es ist *c* die stehende Antriebswelle, mit dem konischen Rade *d*, welches in die beiden konischen Räder *ee* der Rührwellen eingreift. Die Traverse *b* ist an der stehenden Welle *f* befestigt, welche in einem auf der Welle *c* sitzenden Spurlager *g* läuft. Die Richtung der Bewegung des ganzen Systems im Maischbottig hängt von dem Widerstande ab, den die auf den Rührwellen *aa* sitzenden Arme *hh* in der

Fig. 219.



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Maische finden. Die Umgangsgeschwindigkeit des ganzen Systems wird mittelst einer an der Welle *f* befestigten Bremsvorrichtung *i* regulirt. Die Traverse *b* ist in verticaler Richtung auf der Welle *f* und das konische Rad *d* ebenso auf der Welle *c* verschiebbar, demnach auch die beiden Rührwellen *a a*. Soll die Maschine nun die obere Schicht der Treber aufhacken, so werden die Rührwellen nebst Zubehör aus ihrer unteren Lage mittelst der in das Schneckenrad *k* eingreifenden Schnecke *l* im Verein mit dem Zahnrad *m* und der auf der Welle *f* festsitzenden ringförmigen Zahnstange *u* in die obere Lage gehoben. Da der Widerstand, welchen die Arme *h h* in der Maische finden müssen, um das ganze System in Bewegung um seine senkrechte Achse zu setzen, kaum noch in genügendem Grade vorhanden ist, wenn die Maschine in hochgehobener Stellung nur die obersten Schichten des Maischgutes bearbeitet, da hierbei sich also nur die Rührwellen *a a* an Ort und Stelle drehen, so ist eine Vorrichtung angebracht, welche gestattet, die Bewegung des ganzen Systems im Bottiche um die senkrechte Achse nach Belieben herbeizuführen. Dieser Mechanismus besteht aus einer Schnecke, dem Schneckenrade *p* und der Kuppelung *q*. Bei eingerückter Kuppelung kann das System mittelst Handkurbel sowohl vor- als rückwärts umgedreht werden. *r* ist der Hebel zum Aus- und Einrücken der Kuppelung.

Fig. 220.

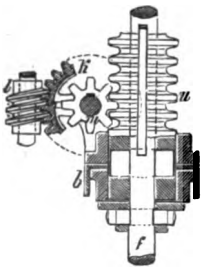
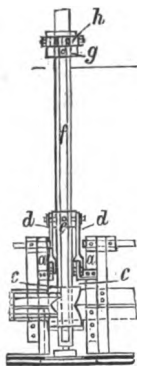


Fig. 221.



Ein von Beck & Rosenbaum in Darmstadt construirter Rühr- und Aufhackflügel besteht aus einem gitterförmigen und aus einem plattenförmigen Teil. Auf die zunächst der stehenden Welle liegenden Arme *a* der beiden plattenförmigen Flügelteile sind, um diese heben und senken zu können, die Oesen *c* aufgenietet. Diese werden von den beiden Zugstangen *d* erfasst, welche beide mit der auf der stehenden Welle verschiebbaren Muffe *e* verbunden sind. Weiter oben sitzt auf der stehenden Welle eine zweite verschiebbare Muffe *g*, welche mit *c* durch die Zugstange *f* verbunden ist. Um die Muffe *g* ist ein Ring *h* gelegt, welcher zwei seitliche Zapfen hat. Wenn diese von dem gabelförmigen Ende eines Hebels erfasst werden, so erfolgt durch Niederdrücken des Hebels das Heben der plattenförmigen Flügel. (D. P. 20660 vom 5. März 1882.)

Nach Leinhaas und Hülsenberg in Freiberg soll die Zerkleinerung von eingeteigten Cerealien durch Zerreissen der mit heftiger Centrifugalkraft gegen eine grosse Reihe scharfkantiger Vorsprünge im Innern eines Centrifugalrades geschleuderten härteren Partikelchen der Mischung erreicht werden. Das Centrifugalrad saugt auch gleichzeitig die Mischung an und schafft sie nach der Zerkleinerung weiter. Der Apparat besteht aus dem einer Centri-

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fugalpumpe ähnlichen Gehäuse *a* (Fig. 222), einem Centrifugalrad eigentümlicher Construction *c* (Fig. 222) und einem mit einer Reihe scharfkantiger

Fig. 222.

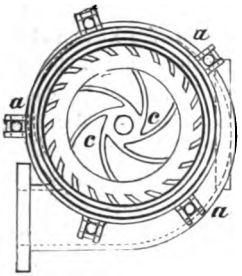
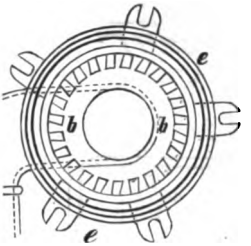


Fig. 223.

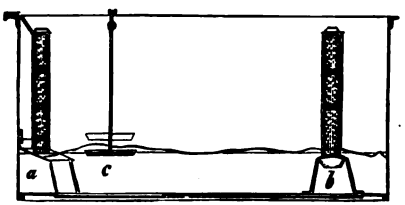


Vorsprünge *bb* versehenen Gehäuseverschlussdeckel *e* (Fig. 223). (D. P. 21292 vom 1. Juli 1882.)

Schäfer in Cörne bei Dortmund ist eine Braupfannen-Einmauerung mit Gasfeuerung patentirt. (D. P. 17831 vom 28. Juni 1881.)

A. Steinecker in Freising führt nach dem D. P. 17938 vom 30. August 1881 das Abläutern von Bierwürzen folgendermassen aus: Vermittelst der Apparate *a*, *b* und *c* wird die Würze entweder unterhalb des Teiges auf die Treber geleitet, oder ein Teil des Teiges ohne Vermischung mit den Trebern entfernt. Der Apparat *a* besteht aus einem schiefstehenden, an der Wand des Bottichs aufgehängten Blech, welches zwei Rohre trägt, die aus mehreren übereinander gesteckten, in ihren oberen Teilen geschlitzten Rohren gebildet sind. Nach der Verzuckerungsperiode zieht die Würze durch die Schlitze der Rohre unter den klebrigen Teig. Der Apparat *b* ist ein verkehrt muldenförmiges Blech, welches auf Füssen steht und dicht unter der Treberdecke liegt; dasselbe trägt Rohre wie der Apparat *a*. Der Apparat *c* ist ein Blech mit Rändern, welches den Teig auffängt. Vor dem Abläutern wird das Blech an Griffen gehoben und etwas höher aufgehängt.

Fig. 224.



Das Bierwürzefilter von Kolb in Strassburg i. E. (D. P. 20231; Fig. 225, folg. Seite) besteht aus einem gusseisernen Kasten *A*, dessen eine grössere Seite *B* vermittelst Scharniere und Pressschrauben *a* geöffnet oder dicht verschlossen werden kann, und dessen Boden ein angeschraubtes Sammelrohr *C* trägt, das oben bündig mit der inneren Bodenfläche des Kastens in diesen letzteren eindringt und mit konischen Löchern *c* versehen ist. In diese konischen Löcher stellen sich die hohlen konischen Ausmündungen *d* der durchlöcherten Plateaus *D*. Diese bestehen aus zwei mit Scharnieren verbundenen Wandungen, deren eine mit Rippen versehen ist,

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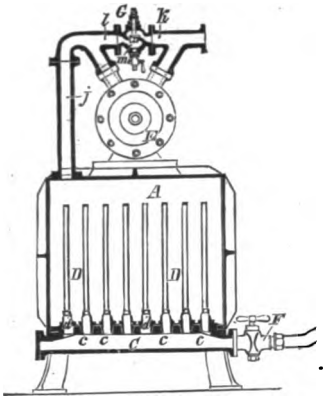
um die Versteifung sowie die Innehaltung eines Zwischenraumes zu bewirken. Jedes dieser Plateaus wird in einen doppelten Sack aus Filtertuch eingehüllt.

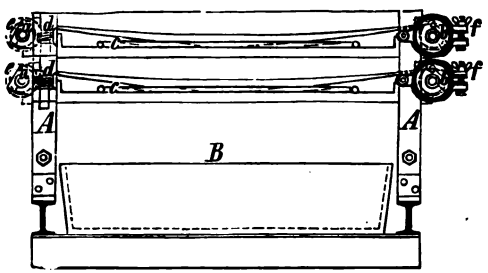
Fig. 225.



Vermittelst der Rotationspumpe *E* wird die zu filtrirende Würze in *i* eingesaugt und durch *j* in den Kasten *A* eingepumpt. Dieser füllt sich an und die Würze dringt durch die Filtersäcke in das Innere des Plateaus *D*, fliesst in das Sammelrohr *C* und wird durch den Hahn *F* klar abgezogen. Um einem zu starken Druck vorzubeugen, sind Saug- und Druckrohr der Pumpe *E* durch die Stützen *k* und *l* verbunden, zwischen welchen das Ventilgehäuse *G* sitzt. Wird der Druck im Kasten zu hoch, so wirkt derselbe von unten auf das Ventil *m*, das sich hebt und den Ueberfluss an eingepumpter Würze wieder in das Saugrohr *k i* ausfliessen lässt.

Der Bierwürze-Filtrirapparat von Dittmann und Sauerländer in Aachen (D. P. 20134 vom 31. Januar 1882) besteht aus dem Rahmen *A*

Fig. 226.



mit seitlich daran gelagerten Walzen *a a* und *b b*, zwischen welche Tücher so gespannt sind, dass sie in der Mitte einen Sack bilden, welcher die zu filtrirende Würze auf nimmt und durchlässt. Die Tücher sind anfangs auf die eisernen Walzen *b b* aufgewickelt und einmal um die Walzen *a a* geschlungen. Unter jedem Tuch liegt ein Drahtnetz *c*. Die Würze kommt aus dem Kühlapparat direct auf das oberste Siebtuch. Beim Filtriren werden die Walzen *a a* durch die Schnecken und Schneckenräder *d d* und *e e* gedreht, so dass sich die Tücher auf die Walzen *a a* auf-, und von den Walzen *b b* abwickeln. Die Spannung wird durch die Bremsen *f f* bewirkt. Schliesslich werden, nachdem der Zufluss der Würze abgestellt ist, die Schneckenräder *e e* von den Walzen *a a* abgenommen und die Tücher abgewickelt und gereinigt. Die filtrirte Würze läuft in den Sammelbottich *B*.

Neubecker in Offenbach a. M. und Welz in Breslau haben an ihrem Läuterapparat Neuerungen angebracht. (D. P. 19726 vom 17. Januar 1882.) Der trichterförmige siebartige Filterboden ist als festes Ganzes hergestellt und wird durch einen mit dem Rührwerk verbundenen Mechanismus gehoben und gesenkt. Auf der Rührwerkswelle ist eine verschiebbare gusseiserne Hülse c

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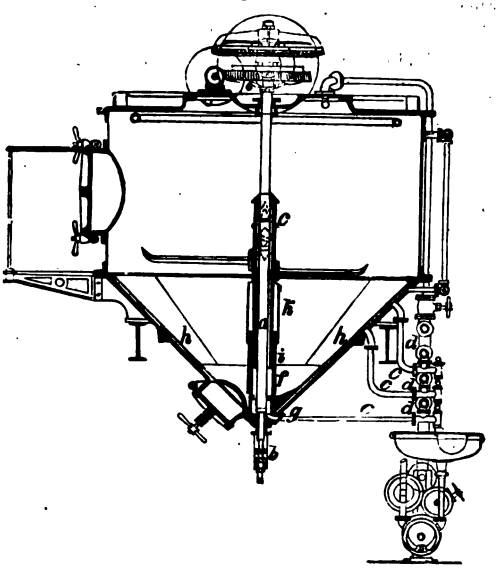
angebracht, deren unterer Teil in die Hülse *f* passt, um welche der Filterboden *h* gedreht werden kann. Ueber einen Teil von *f* ist ein cylindrischer Filterboden *i* aufgepasst, über den sich der cylindrische Filterboden *k*, in dem sich Hülse *c* drehen kann, teleskopartig verschiebt. Beide Arme der Rührwerkstraverse sind mit Filter belegt. Diese Filterräume stehen mit der Hülse *c* in Communication, so dass am unteren Ende von *c*, d. h. in der Spitze des Apparates, sämtliche Läuterflüssigkeit aus *ik* und dem Traversen-Filterboden abgeleitet wird. — Jede der am Filterboden durch eingelegte Leisten gebildeten Zonen steht mit einem Läuterrohr und mit den über einander angeordneten Heisswasserrohren *d* in Verbindung.

Fig. 227.

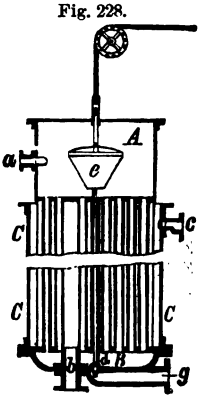


Uckermann in Herford. Einrichtung zum Lüften von Bierwürzen und Maischen mit kalter gereinigter Luft. (D. P. 17979 vom 8. Juli 1881.)

4. Kühlung.

A. Nägeli in Wegeleben giebt dem Kühlapparat folgende Einrichtung. (D. P. 20684 vom 11. Juni 1882.) Die beiden vertical über einander liegenden cylindrischen Gefässe *A* und *B* sind durch zahlreiche verticale eiserne Röhren von ca. 5 cm Durchmesser unter einander verbunden. Durch das centrale Rohr geht eine Stange lose in Führungen beweglich. Dieselbe hat unten einen Ventilkegel *d*, der die Ausflussöffnung *g* völlig abschliessen kann. Am oberen Ende der Stange befindet sich ein kegelförmiger Schwimmer *e*, welcher durch seine Stellung die Ausflussöffnung *d* regulirt. Auf der Deckplatte des Gefässes *B* ist das cylinderförmige Kühlgefäss *C* montirt, welches das Röhrensystem umschliesst. Durch das Gefäss *B* geht ein Rohrstutzen *b* bis in das Kühlgefäss *C* hinein. Durch diesen tritt kaltes Wasser in das Kühlgefäss *C*, aus dem es durch den Rohrstutzen *c* abfliesst. Die zu kühlende

Fig. 228.



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Flüssigkeit wird durch den Rohrstutzen *a* in das Obergefäss *A* gepumpt und füllt die Röhren und das Untergefäss an. Sobald die Flüssigkeit im Gefässe *A* eine bestimmte Höhe erreicht hat, hebt der Schwimmer die Stange und Ventilkegel *d* so lange, bis die Abflussöffnung *g* durch den Kegel so weit freigegeben ist, dass ebensoviel Flüssigkeit durch G abfliessen kann, als durch *a* zufliesst.

Bei dem Kühlapparat von Hölzer in Karlsruhe (D. P. 19713 vom 6. August 1881) besteht die Auflaufvorrichtung für Berieselungs-Kühlapparate aus dem Verteiler *d* mit Seiher *c* und Schlitz *f*. Durch diesen wird die zu kühlende Flüssigkeit auf das oberste Kühlrohr geleitet, von welchem aus dieselbe durch die in den Wänden *g* angebrachten Schlitze über die Kühlrohre rieselt. Der Verschluss der Kühlrohre besteht aus dem Rahmen *m* mit Rippen *n n*, mittelst welcher und des Deckels *p* die Verbindung zweier Kühlrohre hergestellt wird. Dadurch sind die Kühlrohre in ihrer ganzen Weite zugänglich und einer vollständigen Reinigung fähig.

Fig. 229.

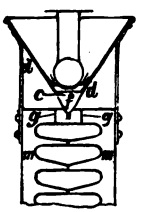
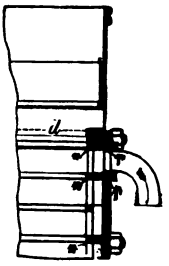
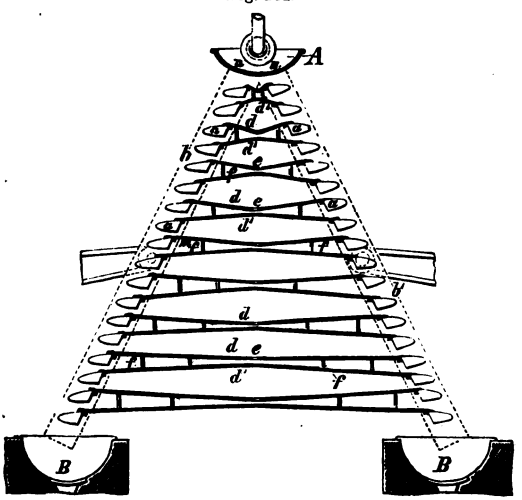


Fig. 230.



Th. Märkisch in Berlin hat seinen Gegenstrom-Kühlapparat*) verbessert. (D. P. 19631 vom 15. April 1882.) Die Kühlrohre *a* sind in den Wänden *b b'* so befestigt, dass zwei von einander getrennte Rohrleitungen entstehen. Zwischen beiden werden Bleche *d d'* von der gezeichneten Form eingeschoben. Die Würze fliesst aus der Rinne *A* durch zwei Reihen feiner Löcher *u* auf das oberste Rohr *a*. Ein Teil fliesst über das nächste Rohr *a* hinweg, der andere Teil wird von dem Blech *d* aufgenommen, fliesst durch die Löcher *e* auf *d'*, läuft von diesem nach aussen auf das nächstfolgende Rohr *a* u. s. f.

Fig. 231.



*) Techn.-chem. Jahrb. 1883, S. 213.

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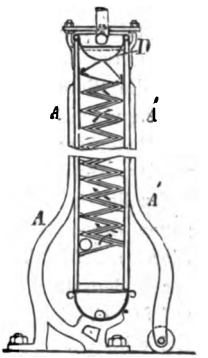
Der Kühlapparat von Mayer in Straubing (D. P. 19897 vom 1. Jan. 1882) besteht aus dem feststehenden Seitenteile *A* und dem auf Rollfüssen befindlichen, mit *A* durch Scharnierbänder verbundenen Seitenteile *A'*. Beide Teile sind innen mit dreieckigen oder anderen Rohren oder Wellblechen versehen, deren nach innen stehende Aussenflächen, welche die Kühlflächen bilden, ca. 12 cm durch Bordschwellen von einander gehalten werden. In den Rohren circulirt das Kühlwasser. Die Enden der Seitenteile werden durch Vorköpfe, welche die Circulation des Kühlwassers ermöglichen, abgedichtet. *D* ist die Verteilungsrinne.

Fig. 232.



Hampel in Dresden hat den Mahlapparat an seinem Maisch- und Kühlapparat verbessert. (D. P. 18215.)

5. Gährung und Hefe.

Ramsay in Brooklyn hat einen Apparat zur Behandlung von gegorenen Flüssigkeiten patentirt, um dieselben zu conserviren und zu oxydiren (D. P. 17830 vom 26. Juni 1881.)

Von Aubry und Lintner ist constatirt, dass Hefe, die zum Gefrieren gebracht wurde, ihr normales Aussehen und ihre volle Lebenskraft behält.

Von der Planitz hat einen gefrorenen Hefezeug, der mit Hammer und Meissel in kleine Stücke zerschlagen werden musste, mit sehr guten Resultaten verwertet. (Allgem. Zeitschr. f. Bierbrauerei und Malzfabrikation, 1883, 6.)

Heinrich Struve macht Mitteilungen über die chemische Dialyse unter Anwendung von Chloroformwasser oder Aether und ihre Bedeutung für die chemische Analyse eiweisshaltiger Substanzen (Journ. f. prakt. Chemie XXVII, 231). Als Diaphragma bediente er sich der tierischen Blase, als Aussenflüssigkeit des Aethers bei der Dialyse von Malz und Hefe. Beim Malz gewann er eine gelblich gefärbte, opalisirende, sauer reagirende Flüssigkeit, die sich durch starken Zuckergehalt und kräftig wirkende Diastase auszeichnete. Bei frischer Bierhefe bekam er ein Diffusat, aus nicht unbedeutenden Quantitäten von Invertin bestehend; quantitativ liessen sich noch nachweisen Lencin, Tyrosin, Glycerinphosphorsäure, Albumin, Pepton. Die Aetherlösung enthielt einen in feinen Nadeln krystallisirenden Körper, sowie Spuren von Buttersäure und Essigsäure.

6. Kellerwesen.

Nach Studien von M. Schwarz (Amerikan. Bierbrauer 1883, 3 und 34) über „Das Pasteurisiren des Bieres und die Trübungen des pasteurisirten Bieres“ ist die Tödtung der Hefe bei 55° C. eine vollständige. Die Hauptforderung des ganzen Processes gipfelt in der vollständig gleichmässigen Erwärmnug in jeder einzelnen Flasche auf die angestrebte Temperatur. Die Temperatur in den Flaschen liegt immer einige Grade

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niedriger als in der äusseren Flüssigkeit, daher muss das Wasser auf 58° C. erwärmt werden, da im anderen Falle die Hefezelle weiter lebt, sich vermehrt, eine durch höhere Temperatur begünstigte schnellere Nachgärung eintritt und die Biere trübe werden. Bei pasteurisirten Bieren, bei welchen alle Bedingungen eines vollkommenen Processes genau erfüllt wurden, besteht der Bodensatz aus Bacterien und Mycelfäden, die ja erst bei 75° C. zerstört werden, sowie aus schwarzen Pünktchen, die als Plasmakörner der todten Hefezelle zu betrachten sind. Die Trübungen eines solchen Bieres sind dagegen durch Glutinausscheidungen hervorgerufen; durch Erwärmen dieses Bieres auf 50° C. im Wasserbade wird dasselbe sofort glanzfrei, ohne dass sich der Bodensatz merklich hebt. Man kann daher durch abermaliges Erwärmen auf 50° C. trüb gewordene pasteurisirte Biere wieder für längere Zeit glanzfrei erhalten.

Das Paraffiniren der Kufen und Fässer dürfte im Laufe der Zeit das Pichen der Lagerfässer und das Lackiren der Gährbottiche vollständig ersetzen. Das Verfahren des Imprägnirens mit Paraffin ist genau angegeben in „Der Bierbrauer" 1883, XIV. Bd. No. 9, 245 und in No. 10 der Allgem. Hopfen-Ztg.

Ueber elektrische Thermometer mit Apparat zum Ablesen der Temperatur in der Entfernung nach Angabe von K. Lintner construirt von M. Sendtner-München siehe Zeitschr. f. d. ges. Brauwesen 1882, S. 254.

Ueber die Verwendung des Eisens zu Fässern in der Bierbrauerei spricht sich T. Jeschek in der Zeitschr. f. d. ges. Brauwesen 1883, S. 210 und 225 dahin aus, dass das Eisen möglicherweise dem Eichenholze stark Concurrenz machen wird, dass jedoch bei der Anwendung des Eisens verschiedene Punkte in Erwägung gezogen werden müssen. Da die Ausscheidung von Gluten und Hopfenharz auch noch während der Nachgärung stattfindet, wenn auch im Verhältnisse zur langsamen Attenuation in geringerem Maasse, so ist dieser Process für die Qualität des Bieres von grosser Wichtigkeit und wird durch die Form der Lagerfässer sehr beeinflusst. Man darf daher eisernen Lagerfässern nicht jede beliebige Form geben, sondern man muss dieselbe den Holzlagerfässern ähnlich construiren oder wenigstens dem oberen Teile derselben eine geeignete Form geben, etwa die einer Kugelhaube oder Kugelspitze. Um das Bier vor der directen Berührung mit dem Eisen im Innern des Fasses zu schützen, eignen sich als Isolirmittel am besten Glasuren. Ist das Bier der Einwirkung des Eisens preisgegeben, so entsteht gerbsaures Eisen.

Bei dem Pechkessel von Hackmann in Dresden (D. P. 20253 vom 15. Februar 1882) wird die Wand *a* seitlich durch das Rohr *b* unterbrochen, welches das Pech direct in die Fässer leitet. Das austretende Quantum wird durch Hahn *c*, der mittelst Stange *d* auf- und zugedreht werden kann, regulirt. Durch das Sieb *e* am Rohr *b* werden feste Körper zurückgehalten. Wird der Kessel mit Coks gefeuert, so leitet das Rohr *g* die Luft von einem Ventilator unter den Rost. Auf dem Rohr *g* ist das Rohr *h* angebracht, um dem oberen Teil des Kessels kalte Luft zuführen zu können, falls Ueber-

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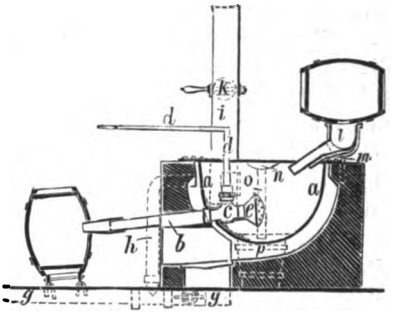
hitzung eingetreten ist. Der Schornstein *i* mit Klappe *k* dient auch zur Coksnachfüllung. Die gepichten Fässer werden auf die Rinne *l* gelegt, durch welche das überflüssige Pech wieder in den Kessel zurückfliesst. Letztere hat eine Höhlung *m*, die durch die Dämpfe aus dem Kessel erwärmt wird. *n* ist ein Ausschnitt am Kessel *a*, damit bei Ueberfüllung desselben das Pech durch das Rohr *o* in den Behälter *p* laufen kann.

Fig. 233.

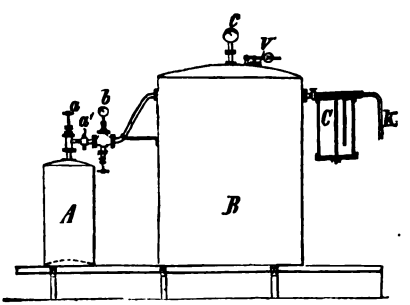


Reininghaus in Steinfeld, Graz. Pichapparat mit erhitzter Luft. (D. P. 19352 vom 7. Februar 1882.) Zum Einlassen beliebiger Luftmengen in den Lufterhitzungsofen ist ein mit Regulirvorrichtung versehenes Rohr angebracht, welches von dem Ventilator her comprimirte Luft unter den Rost führt. Von diesem Rohr führt ein Zweigrohr in den Raum oberhalb der Brennstoffschicht, wo sich die durch das Zweigrohr zugeführte Luft mit den Verbrennungsproducten mischt. Von dort wird das Gemisch in das zu pichende Fass geleitet.

Reichenkron in Charlottenburg stellt Berliner Weissbier aus im Vacuum condensirter Weissbierwürze her. Diese wird in einer kleinen Quantität kochenden Wassers gelöst, mit der passenden Menge kalten Wassers gemischt und mit Weissbierhefe versetzt. Dem Product setzt man eine kleine Menge in kochendem Wasser gelöster Würze zu, die mit einem Drittel der aus der ersten Operation gewonnenen frischen Hefe in Gährung versetzt ist. (D. P. 19558 vom 11. September 1881.)

Wilh. Raydt in Hannover. — Verwendung tropfbar flüssiger Körper beim Heben und Ausschänken von Bier. (D. P. 16826 vom 21. October 1880.) Das Heben und Ausschänken des Bieres soll unter dem Druck der aus tropfbar flüssiger Kohlensäure durch Entlastung entstandenen gasförmigen Kohlensäure geschehen. Dadurch wird vermieden, dass die mittelst Salzsäure aus Marmor entwickelte Kohlensäure Salzsäuredämpfe in das Bier bringt. Der mit dem Absperrventil *a* versehene Behälter der flüssigen Kohlensäure *A* wird durch die Verschraubung a^1 mit dem Windkessel *B* verbunden. Zwischen beiden Behältern ist das Druckreducirventil *b* eingeschaltet. Wenn das Manometer *c* ungenügen-

Fig. 234.



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den Druck in *B* anzeigt, kann das Absperrventil *a* etwas geöffnet werden. Der Windkessel ist noch mit dem Sicherheitsventil *v* versehen. Zwischen *B* und dem Fass befindet sich der Bierfang *C* aus Glas, welcher verhindert, dass beim Anstechen eines neuen Fasses Bier in den Windkessel übertritt. Die Kohlensäure gelangt durch *k* und eine Röhre mit doppelter Wandung in das Fass. Das äussere Rohr reicht nicht ganz so weit bis an den Fassboden, wie das innere, so dass die Kohlensäure eine grosse Schicht des Bieres durchstreichen muss, ehe sie das letztere durch das innere Rohr in die Bierleitung drückt.

Dies Verfahren verdient in jeder Beziehung allgemeine Einführung. Da, wo es benutzt wird, ist man in hohem Grade damit zufrieden. Flüssige Kohlensäure für diesen Zweck wird u. a. in der chemischen Fabrik von Kunheim in Berlin hergestellt.*)

W. Stavenhagen in Halle a. S. — Selbstthätiges Ventil zum oberschichtigen Ablassen getrübter Flüssigkeiten. (D. P. 19277 vom 21. Januar 1882.)

Die Abziehvorrichtung für Fässer von E. Pietsch in Tost (D. P. 18182 vom 24. August 1881) besteht aus einer Büchse, in welcher ein mit Rand versehenes Abschlussrohr durch Auf- und Niederschrauben einer Schraubenmutter mit innerem Rande auf- und niederbewegt werden kann.

A. Nitykowski in Schöneberg. Gefäss zum Transport von Bier. (D. P. 18565 vom 2. November 1881.) Im Innern der aus hartgebranntem, innen glasirtem Thon hergestellten Gefässe sind Luftmaschen angeordnet.

7. Untersuchung des Bieres.

Ueber den Glyceringehalt des Bieres hat Amthor (Biedermann's Central-Blatt f. Agricult.-Chem. 1883, S. 214) Untersuchungen angestellt, welche ergaben, dass derselbe nicht über 0·3 Proc. steigt und nicht unter 0·05 Proc. fällt, dass ferner, je nachdem die Gährung rascher oder langsamer verläuft, der Glyceringehalt innerhalb der angegebenen Grenzen schwankt, und die erstere einen geringeren Glyceringehalt zur Folge hat als die letztere.

J. West-Knights bestimmt das Dextrin in der Malzwürze auf zweierlei Weise. (Ber. d. chem. Gesellsch. 1883, S. 438.) Nach der einen Methode fällt man das Dextrin aus 10 cbcm der Würze mittelst 50 cbcm Alkohol, lässt den Niederschlag gut absetzen, decantirt, wäscht mit mehr Alkohol aus und wiegt nach dem Trocknen im Wasserbade. Als Correctur für die in Lösung gebliebene Dextrinmenge addirt man zu dem Resultat noch 0·045 hinzu. Aus dem Vol.-Gew. der Würze kann man ihren Gehalt an Malzextract berechnen, indem man die Differenz zwischen dem spec. Gewichte derselben und demjenigen von Wasser durch 3·85 dividirt. (Wasser = 1000; jedes Procent des gelösten Malzextractes erhöht das spec. Gewicht um 3·85 pro 1000 cbcm). Nach der zweiten Methode lässt man 100 cbcm der Würze

*) Techn.-chem. Jahrb. 1883, S. 219.

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gegen 100 cbcm Wasser 24 Stunden lang diffundiren. Während nach dieser Zeit jede der beiden Flüssigkeiten die gleiche Menge Zucker enthält, geht das Dextrin als Colloidsubstanz nicht durch die Membran hindurch. Aus der Differenz der Vol.-Gew. beider Flüssigkeiten, dividirt durch 3·85, erhält man den Procentgehalt an Dextrin plus einer geringen Menge an Proteinsubstanzen.

Gg. Holzner findet bei einem Vergleich der Extracttabellen von Balling, Steinheil und Schultze (Zeitschr. f. d. ges. Brauwesen 1883, 67) die Tabellen so übereinstimmend, dass die Abweichungen innerhalb der unvermeidlichen Beobachtungsfehler liegen.

Die Frage, ob das Krystallwasser der Maltose ($C^{12}H^{22}O^{11} + H^2O$) als Bestandteil des Extracts zu betrachten oder bei der Benutzung der Tabelle von Schultze in Abzug zu bringen ist, ist noch zu entscheiden. Da bei der Vergährung eine Hydratation der Maltose stattfindet und somit die Moleküle des Krystallwassers als Bestandteile des Alkohols und der Kohlensäure erscheinen, so muss nach Holzner's Ansicht die erstere Frage bejaht, d. h. das Krystallwasser als Bestandteil des Extracts angesehen werden.

Zum Nachweis der schwefligen Säure im Hopfen und anderen geschwefelten Rohmaterialien, wie Gerste und Malz, sowie im Biere, sind die zweckmässigsten Methoden nach neueren Versuchen der wissenschaftlichen Station für Brauerei in München (Zeitschr. f. d. ges. Brauw. 1883, 145) folgende:

Eine grössere Probe (ca. 10 g) Hopfen wird mit Wasser eine Stunde extrahirt; der Auszug wird nun mit Zink und Salzsäure behandelt und dabei das sich bei Anwesenheit von schwefliger Säure bildende Schwefelwasserstoffgas in 10—15 Minuten durch Bleipapier nachgewiesen. Bei geringen Mengen schwefliger Säure sowie bei quantitativen Bestimmungen derselben muss man den Hopfen mit Wasser destilliren, die erhaltene schweflige Säure oxydiren und als Schwefelsäure mit Baryt bestimmen.

Zur Bestimmung der Gesamtschwefelsäure im Hopfen ist der Hopfen nach Oxydation mit Salpetersäure einzuäschern und darin die Schwefelsäure zu bestimmen.

Bei der Untersuchung der Gerste und des Malzes gelten dieselben Methoden; beim Biere hat man stets zu destilliren; die schon zum grössten Teile in den ersten Mengen des Destillats sich befindende schweflige Säure muss mit Jodlösung zur Ueberführung der schwefligen Säure in Schwefelsäure behandelt und die stark salzsaure Flüssigkeit dann mit Baryumchloridlösung gefällt werden. Am besten bedient man sich dazu des von Haas vorgeschlagenen Apparates, bestehend aus einem 400 cbcm fassendem Destillirkölbchen, in dessen doppelt durchbohrten Kork ein bis fast auf den Boden reichendes Gasleitungsrohr und ein unter dem Pfropfen ausmündendes, zweimal rechtwinklig gebogenes, mit einer Peligot'schen Röhre in Verbindung stehendes Glasrohr stecken. In den Kolben bringt man 100 cbcm Bier und in die Peligot'sche ca. 25—30 cbcm Jodlösung (5 g J und 7·5 KaJ im Liter) und destillirt

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bei möglichster Kühlhaltung der Vorlage im Kohlensäurestrom. Man braucht nur die Hälfte überzudestilliren. Nachdem die Jodlösung aus der Peligot'schen Röhre ausgegossen, mit Salzsäure erhitzt und mit Baryumchlorid gefällt worden, wird der schwefelsaure Baryt gesammelt und gewogen.

Als Ursache der Vollmundigkeit des Bieres giebt Karl Michel (Zeitschr f. d. ges. Brauw. 1883, 185) die Anwesenheit von α und β-Achroodextrin in grösseren Mengen gegenüber dem γ-Achroodextrin an. Da nun jene bei niederer Temperatur mehr als bei höherer gebildet werden, so muss ein Bier aus blassem Malz unter langsamem Aufwärtsmaischen bereitet, stets vollmundiger sein, als ein Bier aus gleichem Material unter Anwendung von höherer Temperatur hergestellt.

8. Allgemeines und Statistik.

Hansen stellte Untersuchungen an über die Organismen, welche zu verschiedenen Jahreszeiten in der Luft in und um Carlsberg vorkommen und in Bierwürzen sich entwickeln können. (Biedermann's Centralbl. f. Agriculturchem. 1883, S. 279.)

Nach den Versuchen entstehen die Keime der Mikroorganismen nicht in der Luft, sondern entstammen der Erde und vermehren sich dort, und hängt der Gehalt der Luft an Keimen mit der Zahl und Art der Herde auf der Erdoberfläche zusammen. Ganz besonders bestätigen die gemachten Beobachtungen diejenigen von Pasteur, dass im Luftstaub nur wenig Hefezellen vorkommen. Es existiren zwei Herde, von wo aus Weingeist-Ferment sich verbreiten kann: von reifen Früchten aus und von dem Erdboden als Ueberwinterungsstelle. In der Luft kommen die Hefezellen am reichlichsten immer zur Zeit der Fruchtreife Ende August und Anfang September vor, alsdann treten auch die Bacterien am zahlreichsten auf und verschiedene andere Hefearten, sog. „wilde Hefe", durch welche die grössten Störungen in der Gährung der Brauereien verursacht werden, besonders bei Benutzung offener Kühlschiffe. Die Mikroorganismen, welche mit dem Staub in die Bierwürze gelangen können und sich darin weiter entwickeln, lassen sich in drei Hauptgruppen bringen. Die Saccharomycesarten, die Bacterien und die Schimmelpilze. Von diesen treten die ersteren am häufigsten auf, die Bacterien schon seltener und die letzteren am seltensten. In den Trebern befand sich eine grosse Anzahl von Bacterien, wie Bacillus subtilis, Mycoderma aceti und andere, die leicht saure Gährungen erzeugen können.

Am 11. März wurde die Versuchs- und Lehranstalt für Brauerei in Berlin in den dazu von Seiten der Staatsregierung erbauten Gebäuden auf dem Territorium der landwirtschaftlichen Hochschule begründet.

Bei den fachlichen Verhandlungen wurde der Vorschlag gemacht, für die Laboratoriumsversuche zum Zwecke der Extractbestimmung das Malz möglichst zu zerkleinern. Dann wurden die Erfahrungen über Erneuerungen in der Sudhauseinrichtung, insbesondere über die Welz-Rittner'schen Läuterungs-Apparate und über die Hilfsapparate von Steinecker ausgetauscht.

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Bei einer Besprechung über Conserviren von Bier wurde Torfstreu aus den Mooren von Oldenburg zum Verpacken der Flaschen, sowie als Isolirungsmittel für Eiskeller empfohlen.

Statistik.

Der Gesamtertrag im Deutschen Reich an Hopfen ist im Jahre 1882 nach Schätzungen der Allgemeinen Brauer- und Hopfenzeitung 1882 No. 79 und 1883 No. 6 und 7 auf ca. 328 650 Ctr. veranschlagt worden; die deutsche Brauerei beansprucht jährlich 310—320 000 Ctr.

Die Gesamterträge anderer Länder sind:

Böhmen über	100 000 Ctr.
Steyermark	5 000 „
Oberösterreich	7 500 „
Galizien über	6 000 „
Siebenbürgen	300 „
Kärnten	800 „
Ungarn und die übrigen Kronländer	1 700 „
Belgien	45 000 „
Frankreich	26 000 „
Holland	4 375 „
Schweden	1 000 „
England	125 000 „
Russland	32 760 „
Amerika, Vereinigte Staaten . . .	190 000 „

Die Gesamtproduction an Bier in der Schweiz im Jahre 1882 belief sich auf 920 000 hl

die Biereinfuhr „ „ „ 64 283 „

„ Bierausfuhr „ „ „ 15 505 „

Im Jahre 1882 wurden in den Vereinigten Staaten gebraut 525 514 635 Gallonen.

In Oesterreich-Ungarn nebst Bosnien und der Herzegowina wurden 1882 12 142 339 hl Bier producirt, und zwar wurden in 2029 Braustätten Unterzeug, in 54 Braustätten Oberzeug und in 48 Braustätten Ober- und Unterzeug fabricirt. (Gambrinus 1883, S. 286.)

Bier in Grossbritannien vom 31. März 1881 bis dato 1882:

	1882			1881		
	Production	Export	Consum	Production	Export	Consum
	Barrels à 163·57 l			Barrels à 163·57 l		
England . . .	6 397 561	99 963	6 297 598	6 138 349	105 388	6 032 961
Schottland . .	284 934	29 144	255 790	240 397	29 841	210 556
Irland	532 218	11 217	521 001	434 708	8 551	426 157
Grossbritannien .	7 214 713	140 324	7 074 389	6 813 454	143 780	6 669 674

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Zuckerverbrauch in den Brauereien von Grossbritannien vom 31. März 1881 bis dato 1882. Nach Angabe der Brauer.

	Centner à 50·8024 kg	
	1882	1881
England . . .	268 922	245 577
Schottland . . .	2 113	1 862
Irland	6 414	5 819
Grossbritannien .	277 449	253 258

(Zeitschr. ges. Brauw. 1882, S. 284.)

Art und Betriebsumfang der Bierbrauereien im Reichssteuergebiet.

Etatsjahr	Von den im Betrieb gewesenen Brauereien haben vorwiegend bereitet obergäriges Bier		untergäriges Bier		an Brausteuer entrichtet							
	gewerbliche	nicht gewerbliche	gewerbliche	nicht gewerbliche	bis 15 ℳ	über 15–60 ℳ	über 60–300 ℳ	über 300–600 ℳ	über 600–1 500 ℳ	über 1 500–6 000 ℳ	über 6 000–15 000 ℳ	über 15 000 ℳ
1	2	3	4	5	6	7	8	9	10	11	12	13
1881/82	608	1197	3260	1	2083	1085	2609	1460	1877	1587	376	189

Vergleichende Uebersicht der Biergewinnung im Reichssteuergebiet und in den übrigen deutschen Staaten.

Jahr	Biergewinnung der einzelnen Steuergebiete.					Auf den Kopf der jeweiligen Bevölkerung entfallen				
	Reichssteuergebiet 1000 hl	Bayern 1000 hl	Württemberg 1000 hl	Baden 1000 hl	Elsass-Lothringen 1000 hl	im Reichssteuergebiet Liter	in Bayern Liter	in Württemberg Liter	in Baden Liter	in Elsass-Lothringen Liter
1881/82	21 316,0	12 341,6	3347,7	1188,8	941,4	62	233	189	71	55

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Biergewinnung im Deutschen Reich im Etatsjahre 1881/82.

Etatsjahre bezw. Zoll- u. Steuer-Directivbezirke	Zahl der im Betriebe gewesenen Brauereien	Darunter gewerbliche Brauereien	Menge der verwendeten steuerpflichtigen Braustoffe		Menge des gewonnenen Bieres				Zur Herstellung von 1 hl Bier wurden durchschnittlich neben einander verwendet	
							Zusammen			
			Getreide	Surrogate	obergäriges	untergäriges		auf den Kopf	Getreide-Malz u. Reis	Surrogate
			Tonnen	Tonnen	1 000 hl	1 000 hl	1 000 hl	Liter	kg	kg
1	2	3	4	5	6	7	8	9	10	11
Provinzen:										
Ostpreussen .	305	279	17 891	44	364,7	298,3	662,8	34,8	27,0	0,07
Westpreussen	108	108	10 172	19	176,8	226,8	403,6	28,7	25,2	0,04
Brandenburg .	560	553	61 265	1 126	1 321,7	1 576,3	2 898,0	85,5	21,1	0,08
Pommern . . .	410	180	9 898	47	113,2	358,3	471,5	30,6	21,0	0,09
Posen	163	162	6 124	32	203,1	155,2	358,3	21,0	17,1	0,09
Schlesien . . .	965	964	31 245	52	1 071,1	845,5	1 916,6	47,8	16,3	0,03
Sachsen	711	704	35 494	227	651,0	1 271,4	1 922,4	85,4	18,5	0,12
Schlesw.-Holst.	804	470	15 415	111	225,4	555,3	780,7	67,7	19,7	0,14
Hannover . . .	516	376	15 197	64	107,3	554,7	722,3	33,5	21,0	0,09
Westfalen. . .	1 533	1 482	27 372	75	110,3	1 059,3	1 169,6	51,3	23,5	0,00
Hessen-Nassau	538	538	28 106	5	41,0	1 208,7	1 249,7	81,5	22,5	0,00
Rheinland . .	1 485	1 449	50 733	219	958,7	1 375,9	2 334,6	57,4	21,3	0,03
Hohenzollern . .	233	233	2 231	1	6,7	95,1	101,8	150,6	21,9	—
Zusamm. preus-Direct. Bez.	8 326	7 493	311 143	2 022	5 411,3	9 580,7	14 992,0	54,6	20,3	0,12
Königr. Sachsen	733	733	51 450	141	1 767,7	1 356,8	3 124,5	105,1	16,5	0,04
Hessen	294	294	17 330	22	4,4	736,5	740,9	79,1	23,4	0,00
Mecklenburg . .	470	118	5 100	28	94,9	122,4	286,4	42,4	17,6	0,10
Thüringen. . . .	1 171	1 167	33 805	28	384,4	1 220,3	1 604,7	126,2	21,1	0,02
Oldenburg . . .	111	106	1 984	2	31,8	69,4	101,2	39,2	19,6	0,02
Braunschweig .	88	84	5 516	8	25,6	232,7	258,4	78,9	21,4	0,03
Anhalt	73	73	3 772	31	94,6	113,4	208,0	89,4	18,1	0,15

Otto Reinke.

XXV. Spiritus.

1. Rohmaterial.

a) **Anbau und Aufbewahrung.** Beim Zerschneiden der Kartoffeln als Saatgut ist nach Wollny zu beachten, das bei einem senkrecht zur Längsachse geführten Schnitt das Gipfelende bessere Ernten ergiebt, als das Nabelende. Die grössten ganzen Knollen bringen aber bei gleichen Bedingungen stets die höchsten Erträge gegenüber mittelgrossen und halbirten Knollen. (Zeitschr. f. Spiritusind. 1882, 337.)

Kartoffelanbauversuche mit mehreren Sorten und in grösserem Maassstabe stellten an: Jakobs (Sierniki), Vibrans (Calvörde) und Heine (Emersleben). Ersterer erhielt die besten Erträge von der Seedkartoffel,

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der zweite von „Imperator„ und „Trophime“, während er „Champion“ ganz verwirft, der letzte fand wie in den Vorjahren „Alkohol“, „Eos“ und „Aurora“ als die ertragreichsten Sorten. (Zeitschr. f. Spiritusind. 1882, 512; 1883, 37 und 181.)

Zur Verhütung der Kartoffelkrankheit und der Kartoffelfäule geben Jensen und Schrohe eine Anleitung (l. c. 1883, 11 und 16.).

Die Düngung der Kartoffeln behandelt Märcker in einer Reihe von Aufsätzen, welche die Resultate älterer und eigener Versuche zusammenfassen (l. c. 1883, 159 ff.).

Ueber Kartoffelerntemaschinen finden sich Angaben in der Zeitschrift f. Spiritusind. 1883, 37, 120 und 308.

Ueber die Umwandlung der Stärke in Zucker in den Kartoffeln und die Verathmung der letzteren beim Lagern hat H. Müller-Thurgau eine Untersuchung angestellt. Die Zuckerbildung in den Kartoffeln wird verursacht durch ein diastatisches Ferment, welches um so ausgiebiger wirkt, je niedriger die Temperatur ist. Neben diesem Vorgang der Zuckerbildung findet gleichzeitig ein Verbrauch an Zucker durch Athmung statt, welcher jedoch um so geringer wird, je niedriger die Temperatur ist. Die Zuckerbildung in den Kartoffeln unterbleibt bei schnellem Gefrieren der Kartoffeln (unter —3°); die günstigsten Bedingungen für das Süsswerden sind längeres Abkühlen auf Temperaturen unter 0°. Süsse Kartoffeln werden wieder zuckerfrei, wenn sie auf höhere Temperatur gebracht werden, weil dann die Athmung die Zuckerbildung übertrifft. (Zeitschr. f. Spiritusind. 1883, 194.)

Für die Praxis zieht Holdefleiss aus den obigen Resultaten folgende Schlüsse: Süss gewordene Kartoffeln sind für die Praxis vollständig nutzbar, haltbar wie im natürlichen Lebenszustande, schneller keimfähig, zum Viehfutter tauglich und von den Tieren gern genommen; für Brennereizwecke sind sie natürlich von gleichem Wert wie nicht süsse, man muss sie nur bei möglichst niederer Temperatur aufbewahren, damit der Zucker nicht verathmet wird; ebenso bleiben sie für die Stärkefabrikation von Wert, da durch einwöchentliches Liegenlassen derselben bei 20—30° C $^4/_5$ des Zuckers in Stärke zurückverwandelt wird. (Landwirt 1883, 42.)

Köhne, Lücke und Böckelmann (Atzendorf) haben bei grossem Kartoffelvorrat mit Erfolg die Kartoffeln nach dem Zerkleinern mit einer Futterrübenschneidmaschine auf der Cichoriendarre gedarrt. Die im Hollefreundschen Maischapparat gemaischte und im Bohm'schen Apparat zerkleinerte Maische war äusserst fein, die Aufschliessung vollkommen. (Zeitschr. f. Spiritusind. 1882, No. 15, 312.)

Bei starkem Auftreten der Kartoffelkrankheit empfiehlt Delbrück die ganze Ernte gleich zu Beginn im Henze zu dämpfen und in Gruben einzustampfen. (l. c. 1882, No. 16, 326.)

b) Untersuchung des Rohmaterials. Die stickstoffhaltigen Bestandteile der Kartoffeln machten E. Schulze und J. Barbieri zum Gegenstande

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einer grösseren Untersuchung. Im Safte von vier Kartoffelsorten konnten sie ausser den Eiweissstoffen nachweisen: Peptone (in sehr geringer Menge), Hypoxanthin, Asparagin, Leucin und Tyrosin. Quantitativ fanden sie, dass der Gesamtstickstoff der Kartoffeln rund zur einen Hälfte auf Eiweiss-, zur anderen auf Amidstickstoff fällt, dass aber bei verschiedenen Kartoffelsorten entweder der Eiweiss- oder der Amidstickstoff dieses Mittel überschreitet. So enthielt die Bisquitkartoffel und Bodenberger Kartoffel den höchsten Gehalt an Eiweissstickstoff (bis zu 65 Proc. des Gesamtstickstoffs), die Rosenkartoffel den geringsten (bis herab zu 44 Proc.). (Zeitschr. f. Spiritusind. 1883, 25.)

Siewert fand in Kartoffeln 0·017 und 0·0572 Proc. Oxalsäure, im Malz 0·0015 Proc., in Malzkeimen 0·064 Proc. Eine Incrustation im Maischkühlrohre erwies sich als oxalsaurer Kalk. Verfasser wies in 1 l Maische incl. Trebern 0·134 g, in 1 l vergorener Maische 0·155 g und in 1 l Schlempe 0·196 g Oxalsäure nach. (Die landwirtsch. Versuchsstat. 1882, XXVIII. Heft IV.)

G. Francke fand in ausgewachsenem Roggen 15·5 Proc. Wasser und 61 Proc. stickstofffreie Extractstoffe, von denen 5·44 Proc. Zucker und 9·71 Proc. Dextrin waren. Durch Erwärmen von 20 g des mit Wasser eingemaischten Roggens auf 49° während zwei Stunden, ergab sich, dass derselbe soviel Diastase enthielt, dass von den 56·56 Proc. Stärke und Dextrin 52·5 Proc. verzuckert wurden und der Rest von 3·06 Proc. nur deshalb nicht verzuckert war, weil er nicht genügende Verkleisterung erfahren hatte. Der ausgewachsene Roggen kann also mit Erfolg an Stelle des Gerstenmalzes verwandt, dann also nicht gedämpft, im Vormaischbottich zugegeben werden. Will man ihn aber nicht als Malzersatz verwenden, so darf er nur bei nicht über $2^1/_2$ Atmosphären im Henze gedämpft werden, damit der in ihm vorhandene Zucker nicht zerstört wird. (Zeitschr. f. Spiritusind. 1882, 367.)

K. Kruis fand bei einer gleichartig vorgenommenen Untersuchung von ausgewachsener Gerste und von Weizen weniger grosse Zucker- und Dextrinmengen und ein viel geringeres diastatisches Vermögen. (Oesterr.-ung. Brennerei-Ztg. 1882.)

G. Francke prüfte die bisher üblichen Methoden der Stärkebestimmung in Körnerfrüchten etc. auf ihre Zuverlässigkeit. Die Aufschliessung mit 1 proc. Schwefelsäure unter Druck gab stets zu hohe Zahlen (herrührend von mitzersetzter Cellulose); das Verfahren der Vorverzuckerung bei 50° C. mit Diastase mit nachfolgendem mehrstündigem Erhitzen auf 140° C. und Inversion mit Salzsäure zu niedrige Zahlen. Zunächst stellte Verf. durch Anwendung des Verfahrens auf reine Stärke, deren Stärkegehalt durch directe Inversion mit Salzsäure bestimmt war, fest, dass ein um etwa 5 Proc. zu niedriger Stärkegehalt nach jenem Verfahren erzielt wurde. Frischer Malzauszug und Glycerinmalzauszug gaben gleiche Resultate. Dagegen ergab sich durch einen Versuch mit Maltoselösung, deren Gehalt an Maltose durch directe Inversion mit Salzsäure und Behandlung des gebildeten Traubenzuckers mit Fehling'scher Lösung zu 5.13 Proc. festgestellt war, dass nach vierstündigem Erhitzen dieser Lösung auf 140° C., nachfolgender Inversion

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und Behandlung wie vorher nur noch 4.75 Proc. Maltose vorhanden, 7.4 Proc. der angewandten Maltose durch die Behandlung mit Wasser unter Druck in nicht mehr reducirende Körper zersetzt waren. Ein Zusatz von Milchsäure hinderte, wie ein Versuch mit reiner Stärke bewies, diese Zersetzung des Zuckers bei der Methode vorheriger Verzuckerung und nachfolgendem Behandeln mit Wasser unter Druck nicht. Zudem erwies sich, dass die Feinheit des Materials von grosser Wesentlichkeit ist, da bei feingemahlenem Mais 3 Proc. Stärke mehr gefunden wurden als bei grobgemahlenem, bei Einhaltung derselben Versuchsbedingungen.

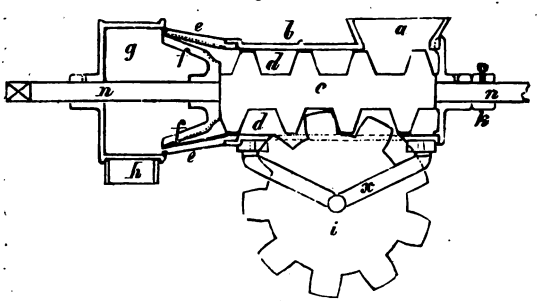
Es geht aus alle dem hervor, dass die alte Methode der Vorverzuckerung ungenügend ist. Bei einfachem Aufschliessen mit Wasser unter Druck ergiebt sich aber die Schwierigkeit, dass die erst gelöste Stärke sich leicht ausscheidet und die Filtration von den Trebern verhindert. Dem suchte Siewert-Danzig durch Zusatz von Weinsäure zu begegnen; Francke wendet an ihrer Stelle Milchsäure an, welche die gelöste Stärke länger in Lösung erhält. Dabei darf aber ein Gehalt von 0·5 Proc. nicht überschritten werden, da sonst durch Aufschliessung von Cellulose zu hohe Resultate erzielt werden, wie Verf. an einer Maisprobe feststellte. Durch einen anderen Versuch constatirte Verf., dass durch die Einwirkung von Wasser bei 140° C. der schon vorhandene Zuckergehalt der Körnerfrüchte (Mais) um ca. 5 Proc. erhöht wird, dass aber bei Zusatz von 0·1 g Milchsäure auf 50 cbcm Wasser eine weitere Erhöhung nicht eintritt.

Versuche der Aufschliessung durch directes Erhitzen der Körnerfrüchte mit Salzsäure im Wasserbade ergaben stets wechselnde Zahlen für den Stärkegehalt. Verf. empfiehlt daher die Aufschliessung mit Wasser unter Druck unter eventueller Benutzung von Milchsäure. (Zeitschr. f. Spiritusind. 1882 15, 306.)

c) **Vorbereitung des Rohmaterials.** Kartoffelwaschmaschinen (s unter „Stärke" S. 274).

Kartoffel-Zerkleinerungs-Apparat von Carl Schmidt in Zweibrücken. (D. P. 20787 vom 12. März 1882.) Die Kartoffeln etc. werden in gekochtem Zustand in den an einem Ende des Apparates angebrachten Trichter *a* gegeben und fallen in den liegenden Cylinder *b*, in welchem sich eine Transportschnecke *c* befindet, durch deren Umdrehung die Kartoffeln in den Gängen *d* fortgegt werden. Am anderen Ende des Cylinders befindet sich das konische,

Fig. 235.



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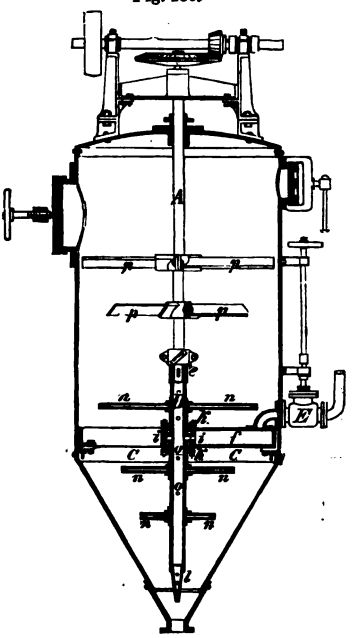
handen, ndig scharf gerippte Gehäuse *e*. In diesem Gehäuse liegt ein entspre- lass- ender Konus *f*, der ebenfalls scharf gerippt und mit der Schnecke *c* auf der Axe *n* befestigt ist, bei deren Umdrehung die Kartoffeln zerkleinert werden. Damit sich die Kartoffeln in den Windungen *d* der Transportschnecke nicht verstopfen, ist der umhüllende Cylinder *b* unten aufgeschlitzt. Durch denselben bewegt sich die Zahnscheibe *i*, welche unterhalb desselben, gehalten durch zwei Bügel *x*, ihren Drehpunkt hat und von der Schnecke *c* in Rotation gesetzt wird.

Nach John Fordreed in Tottenham (D. P. 20686 vom 13. Juni 1882) wird Gerste (Mais oder Reis) gelinde geröstet (bei 104—188°), abgekühlt und zerkleinert. Die Kerne sind dann sehr angeschwollen, die Haut ist geborsten und der physische Zustand hat sich bedeutend geändert. Die Gerste ähnelt im Aussehen und Geschmack dem braunen oder gelben Malz. Eine geeignete Röstmaschine ist eine solche mit hohlen Schildzapfen zum Tragen des Cylinders. Durch einen derselben kann ein Löffel eingeführt werden, um Proben des behandelten Materials herauszunehmen. Im Innern des Cylinders sind Blecheisenstreifen von ungefähr 5 cm Breite, in der Längsrichtung ungefähr 15 cm aus einander festgenietet; dieselben dienen dazu, die Gerste während des Rotirens des Cylinders zu heben und zu verteilen.

2. Dämpfen.

J. E. Christoph in Nisky ist ein Hochdruckdämpfer patentirt. (D. P. 18345 vom 13. November 1881.) In dem Henze-Dämpfer befindet sich eine stehende Welle *A*, welche durch eine Stopfbüchse den Oberboden durchdringt und mittelst konischer Räder und Riemscheibe ihren Antrieb erhält. Bei *e* ist die Welle in ein gusseisernes Rohr *B* eingepasst und verkeilt, so dass das Rohr *B* von der Welle *A* getragen und gezwungen wird, an der Rotation teilzunehmen. Dicht über dem konischen Teil des Henze-Dämpfers ist ein Quersteg *C* eingepasst, dessen einer Schenkel *f* hohl gegossen ist und das Verbindungsrohr bildet zwischen dem Dampfsperrventil *E* und dem ausgebohrten Nabenteil *i* des Steges. Das Rohr *B* ist an dieser Stelle ringförmig verstärkt, und dieser Ring ist mit sechs radial gebohrten Löchern versehen, durch welche der Dampf vom Stegrohr *f* aus fortwährend in das Innere des

Fig. 236.



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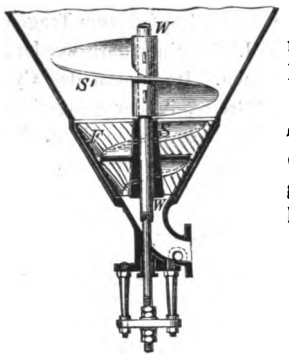
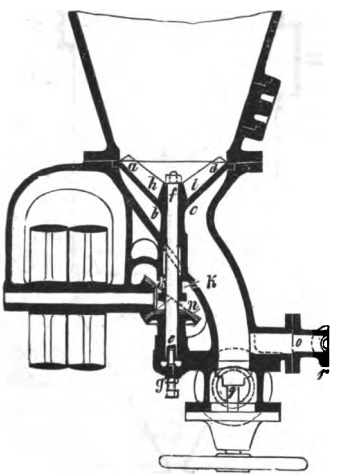
rotirenden Rohres *B* einströmen kann. Gegen das Eindringen von Maischgut in diese Dampföffnungen ist das Rohr durch die beiden Stopfbüchsen *k* geschützt. Das untere Ende des Rohres *B* ist durch einen hohlen durchlöcherten Konus *l* abgeschlossen, durch dessen Löcher der Dampf in die Spitze des Henze-Konus strömt und hier das Maischgut dämpft. Ausserdem sind am Rohr *B* Rührarme *n* angeschraubt. Diese sind der Länge nach durchbohrt, und die hohle Welle *B* ist an den entsprechenden Stellen mit kleinen Löchern versehen, so dass an jedem Rührarmende der Dampf frei ausströmen kann. Ferner befinden sich zwischen je zwei Rührarmpaaren in der hohlen Welle noch kleinere Dampföffnungen *o*. Auf der oberen Welle *A* sind mehrere aus Flacheisen hergestellte Rührarme *p* befestigt, welche vermöge ihrer schrägen Stellung die Körner stets nach oben zu treiben suchen, sobald sich die Welle *A* dreht.

Fig. 237.



Der Entleerungs- und Zerkleinerungs-Apparat im Henzedämpfer von C. F. Mentz in Schilleningken, Ostpreussen (D. P. 19169 vom 31. Januar 1882) soll ermöglichen, den Henze-Dämpfer ohne Anwendung von Dampfdruck zu entleeren und den Inhalt dabei zugleich zu zerkleinern. In dem unteren Teil der konischen Endung des Henze-Dämpfers wird ein mit inneren Mahlzähnen versehenes kegelförmiges Futter *F* eingesetzt. In demselben bewegt sich eine auf der Welle *W* sitzende Schraube *S*, über welcher eine zweite Schraube *S*, welche jedoch nur als Transportschraube dient, angebracht werden kann. Die Schraube *S* dient zugleich als Mahlkugel, indem sie an der geriffelten Innenfläche von *F* sich vorbeibewegend, den Inhalt des Apparates zerkleinert. Fig. 237.

Fig. 238.



Ein Apparat zum Ausscheiden der Nicht-Stärketeile gekochter Kartoffeln von Maage in Landsberg a. W. (D. P. 17950 vom 10. April 1881, Fig. 238) ist an seinem oberen Ende mit Flantschen versehen, um dieselben an den unteren Teil eines Henze'schen Dämpfapparates anzuschrauben. *abcd* ist eine trichterförmige und mit vielen kleinen Löchern versehene doppelte oder einfache Siebfläche; *ef* ist eine kleine stehende Welle, welche in dem gebohrten Teil *bc* und in der Stopfbüchse *kk* geführt wird und, unten mit Stahlkegel

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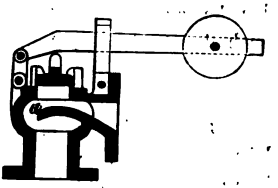
versehen, auf der verstellbaren Stahlschraube *g* ruht; *h i* ist ein auf der Welle *f* vermittelst Schraubenmutter befestigtes Flügelkreuz mit mehreren seitlich gebogenen Flügeln, welche sich dicht über der Siebfläche drehend bewegen. *o* ist ein Stutzen mit Dampfeinlassventil, *q* das Ausblaseventil. Die Flügel zerkleinern die Kartoffeln, und der Dampfdruck treibt die Stärketeile durch die Siebfläche hindurch, während durch die gebogene Form der Flügel die Schalen, Hülsen etc. nach dem äusseren Teil der Siebfläche geschafft bezw. durch angebrachte Reinigungsöffnungen hindurch aus dem Apparat geworfen werden.

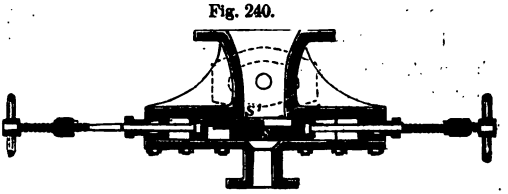
Das von Prankel in Gross-Strehlitz construirte Sicherheits-Ventil für den Henze-Dämpfer ist zwischen dem Dampfzuleitungsrohr und dem Dämpfer so angeordnet, dass der zuströmende Dampf die Kammer des Sicherheitsventils passiren muss, ehe er in den Dämpfer gelangt. In die Kammer des Ventils ist eine Scheidewand *a* so eingefügt, dass die dem Kochapparat zugekehrte Seite als Anprallfläche für aus dem Dämpfer aufsteigende Substanzen dient und die dem Sicherheitsventil zugekehrte Seite den Dampf zwingt, scharf unter die Ventilfläche zu blasen, so dass Massenteilchen, welche durch die für die Dampfausströmung in der Scheidewand ausgesparte Oeffnung ihren Weg nach oben nehmen, von dem eintretenden Dampfstral hinweggerissen werden. (D. P. 18172 vom 13. November 1881.)

Fig. 239.



Ein Zerkleinerungsapparat für gedämpfte Kartoffeln von W. Reimann in Frankfurt a. O. (D. P. 18868 vom 2. November 1881) besteht aus einem gusseisernen Gehäuse mit Anschlussstutzen an dem Dampfkochapparat und einem Eckventil, welches durch ein Rohr zum Vormaischbottich führt. In dem Gehäuse befinden sich zwei Schieber S^1 und S^2, von denen S^1 eine volle Platte ist, während S^2 rostförmig eingelegte Stahlmesser fasst, welche beide ganz vor die Durchgangsöffnung vom Henze-Apparat zu dem Ventil vorgeschoben werden können, so dass man bei Verstopfungen den Durchgang freimachen kann.

Fig. 240.



Delbrück fand bei Versuchen mit dem Barthel'schen Zerkleinerungs-Apparat*) eine vollständige Wirkung, hohe Sacharometeranzeige der Maische, Abwesenheit unzerkleinerter Körner und 2 Literprocent vom Pfund Getreide Mehrausbeute gegenüber Versuchen ohne dessen Einschaltung, welche noch dazu sehr leicht und billig erfolgen kann. (Zeitschr. f. Spiritus-Ind. 1882, 435.)

*) Techn.-chem. Jahrb. 1883, S. 221.

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Wittelshöfer hat mit dem Barthel'schen Apparat (bei vorherigem Quellen der Körner ohne Schwefelsäure und Dämpfen bei 3½ Atmosphären) weniger gute Resultate zu verzeichnen, namentlich wurde auch durch Verstopfung des Rostes vor dem Rohr die Ausblasezeit erheblich verlängert. (l. c. 503.)

Veranlasst durch die Erfahrung, dass durch zu starkes Dämpfen die Spiritus-Ausbeute verringert wird, unterwarf G. Francke die verschiedenen Methoden der Aufschliessung wie sie im Labaratorium zur Bestimmung des Stärkegehaltes von Körnerfrüchten üblich waren, einer Prüfung und fand auf diesem Wege, dass obigen Thatsachen eine Zersetzung des in Körnerfrüchten, Kartoffeln etc. fertig vorhandenen und des aus einem Teil der Stärke bei Einwirkung von Wasser unter Hochdruck entstehenden Zuckers bei zu hohem Drucke zu Grunde liegt. (Zeitschr. f. Spiritusind. 1882, S. 305.) (Vergl. auch den Bericht S. 326.)

3. Maischen.

a) **Theorie der Fermentwirkung.** Detmer stellte Versuche über die Einwirkung von Säuren und Alkalien auf den diastatischen Process an. Kohlensäure beschleunigte die Umwandlung der Stärke durch Diastase. Citronensäure, Salzsäure und Phosphorsäure verhalten sich in sehr geringer Menge ebenso, überschreitet man jedoch eine bestimmte Menge des Zusatzes, so wird die diastatische Wirkung verlangsamt und bei steigendem Gehalte an diesen Säuren endlich ganz unterdrückt. Karbolsäure wirkt erst in verhältnismässig grossen Mengen nachteilig. Alkalien schwächen schon in sehr geringer Quantität zugesetzt die diastatische Wirkung und vernichten dieselbe in grösserer Menge gänzlich. (Zeitschr. f. physiol. Chem. VII. S. 1.)

Untersuchungen über das diastatische Ferment der Bacterien führten J. Wartmann zu folgenden Anschauungen: Die Bacterien können sowol Stärkekörner, wie Stärkekleister und gelöste Stärke in der nämlichen Weise verändern und zwar verschiedene Stärkesorten mit verschiedener Geschwindigkeit, wie die Diastase. Einen Einfluss auf die Stärke üben die Bacterien jedoch nur bei Abwesenheit einer anderen benutzbaren Kohlenstoffverbindung und bei Luftzutritt aus. Die Wirkung wird von einem durch die Bacterien ausgeschiedenen Ferment hervorgerufen, welches gleich der Diastase in Wasser löslich, in Alkohol nicht löslich ist, aber nur Stärke in Zucker verwandelt, nicht peptonisirend wirkt. Das Ferment wirkt auch bei Sauerstoffabwesenheit, wird auch in neutralen, stärkeren Lösungen von den Bacterien abgeschieden und wirkungsvoll; in schwach saurer Lösung wird seine Wirkung beschleunigt. (Zeitschr. f. physiolog. Chem. 1882, 287.)

Bachet hat ein Verfahren angegeben, die Zuckerbildung in mehl- und stärkehaltigen Stoffen durch Gluten, Wasser und Wärme zu bewirken. (Zeitschr. f. Spiritusind. III, 8 und 9.) G. Heinzelmann prüfte dasselbe im kleinen und fand, dass durch das Gluten im Roggenschrot beim Einmaischen mit Wasser bei 60° C. allerdings Verzuckerung stattfindet,

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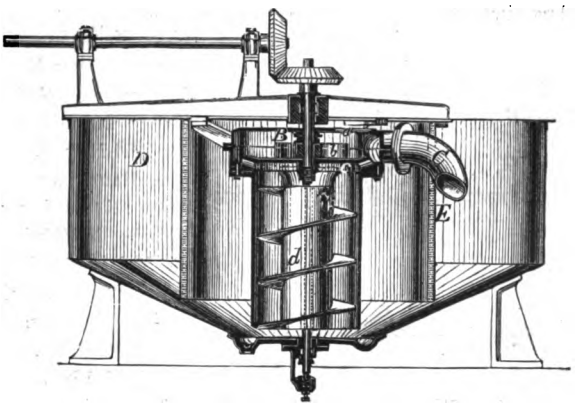
wenn auch nicht in dem Maasse, wie es Bachet angiebt. Störend wirkt die leicht eintretende Säurebildung. Verf. hält Versuche im Grossen zur Feststellung der Malzersparnis für wünschenswert. (Zeitschr. f. Spiritusindustrie 1882, 457.)

b) Maischen und Kühlen. Bechstein in Altenburg. Maischapparat. (D. P. 19062 vom 1. October 1881.) Die zu maischenden Cerealien werden aus einem Exhaustorrohr in die Oeffnung *a* des Gehäuses *B* geführt. Hier werden dieselben von den Flügeln *b* erfasst und durch das Rohr *C* in den Maischbottich befördert. Durch die eigentümliche Stellung dieses Knierohres *C* wird eine lebhafte Strömung des Maischgutes nach den Kühlcylindern *E* aus Wellblech bewirkt. Die Schnecke oder Schraube *d* transportirt das Material nach oben; dasselbe gelangt zwischen die Mahlflächen bei *c* und wird von den Flügeln *b* wieder durch Rohr *C* in den Bottich *D* geführt.

Fig. 241.



Der Maisch- und Kühlapparat der Actien-Gesellschaft H. F. Eckert in Berlin (D. P. 19129 vom 15. Januar 1882) besteht aus dem runden schmiedeeisernen Gefäss *a*, dessen Boden nach unten konisch zulaufend geformt ist. In der Mitte des Apparates ist die stehende Welle *b* angebracht. Dieselbe trägt am unteren Ende den Mischflügel *c*, welcher, in Rotation versetzt, die im Apparat befindliche Maische in Bewegung bringt und dadurch die Maischung bewirkt. Um nach stattgefundener Verzuckerung das Kühlen der Maische zu bewerkstelligen, ist folgende Einrichtung getroffen: Oben, quer über dem Apparat, liegen die hohlen, durch Scheidewände in mehrere Abteilungen getrennten, gusseisernen Balken *d d*, an denen die Kühlröhrensyteme *e e* in den Apparat hineinhängen. Das Kühl-

Fig. 242.

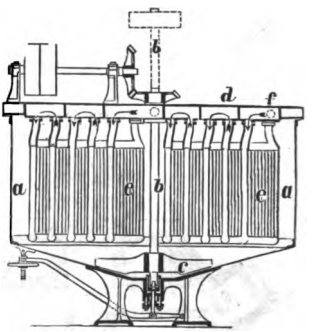
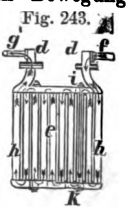


Fig. 243.



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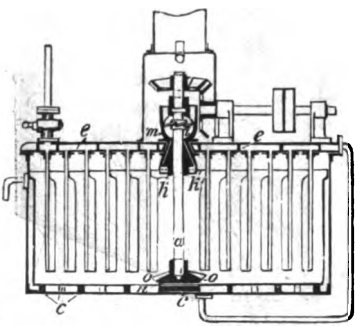
wasser tritt bei *f* in die hohlen Balken ein, strömt durch die Röhrensysteme und verlässt bei *g* den Appararat. Die Kühlröhrensysteme sind je aus einer Anzahl Röhren *h h*, dem oberen Verbindungsteil *i* und dem unteren *k* gebildet. Die Röhren sind mit dem oberen und unteren Teil nicht fest, sondern nur durch Schrauben verbunden, können also in kurzer Zeit in einzelne Teile zerlegt und gereinigt werden.

Bei dem Maisch- und Kühlbottich von Gebr. Pietzsch in Schwiebus sitzt auf der Mitte des die Kühlschaufeln tragenden Canalbalkens die obere Zerkleinerungsmühle. Diese besteht aus dem Mahlgehäuse *k'* mit dem fest auf der Welle *a* sitzenden Mahlkörper *k*. Oberhalb *k* befindet sich der Behälter *i*, in den die Maische vom Henze aus zugeführt wird, mit dem Flügelrad *m*; dieses führt die Maische der Mühle zu. Aus dieser fällt die Maische auf die Bodenmühle *o n*, deren untere Scheibe *n* fest auf dem Boden sitzt und das Spurlager für Welle *a* trägt. (D. P. 20653 vom 20. Juni 1881.)

Fig. 244.



Chr. Wery in Zweibrücken hat seinen Maischapparat verbessert (D. P. 17898 vom 10. Juli 1881).*) Der Maischbottich ist so construirt, dass er drei Canäle bildet. Diese gestatten, ein grosses Quantum Maische mit einer kleinen Trommel bei verhältnismässig geringem Kraftaufwand zu verarbeiten. Es befindet sich nicht, wie früher, das ganze zu verarbeitende Quantum über der Trommel und übt auf diese Druck aus, sondern es hat durch diese Anordnung die Trommel blos die Maische durch den Kropf zu ziehen, da sich dieselbe nur bis an die Trommelachse stellt

Fig. 245.

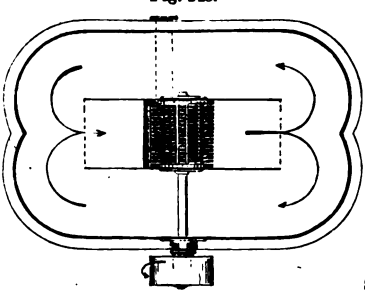
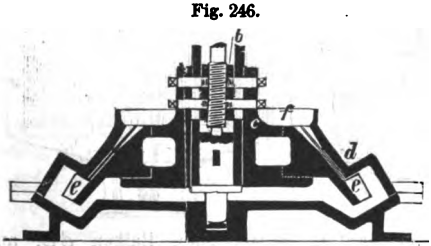


Fig. 246.



Mecklenburgische Maschinen- und Wagenbau-Actiengesellschaft in Güstrow. Der verstellbare Maisch-Zerkleinerungsapparat (D. P. 19101 vom 23. November 1881) ist zum Einsetzen in einen Vormaischbottich bestimmt. Die Verstellung wird durch Drehen eines

*) Techn.-chem. Jahrb. 1883, S. 223.

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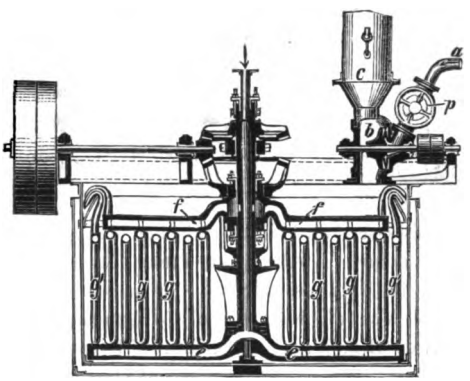
oberhalb des Bottichs befindlichen Handrades bewirkt, wodurch die Metallmutter *b* herauf- bezw. herunter bewegt wird. Mahlstein *c* und Gehäuse *d* sind geriffelt. Am Umfang des Läufers befinden sich kleine Centrifugalschaufeln *e*, welche die Wirkung haben, dass die noch nicht zerkleinerte Maische in den Einlauf *f* des Zerkleinerungsapparates hineingezogen, herumgeschleudert und zerrieben wird.

Die Malz- und Maischmühle von U. Urban in Mocker bei Thorn besteht aus einem messingenen Flügelrade, dessen sechs Flügel an den Enden Gussstahlmesser tragen. Ein System von 20 gussstählernen Messern umgiebt das Flügelrad in $1^1/_2$ bis 2 mm Entfernung von dessen Peripherie. Ein Gehäuse umschliesst das Ganze spiralförmig. (D. P. 18869.)

Bei dem Apparat von Saul & Hoffmann in Frankfurt a. O. (D. P. 18009 vom 6. August 1881) wird die vom Henzekessel kommende Masse vermittelst des Rohres *a* einem Mahlapparat zugeführt. Von diesem saugt ein Exhaustor *c* die Dämpfe ab. In dem Bottich erfolgt die Kühlung durch Kupferrohre *g*, welche zum Teil an einem oberen Arm *ff* und zum Teil an einem unteren *e e* befestigt sind und durch entsprechende Räderordnung im entgegengesetzten Sinne an einander vorbei bewegt werden. Auf dem Maischapparat befindet sich eine Pumpe, welche die Maische aus dem Bottich ansaugt und durch den Mahlapparat drückt. Der Mahlapparat ist mit einem Doppelsitzventil *p* versehen, welches die Communication mit dem Henze und mit der Pumpe gestattet.

Fig. 247.



Der Kühlapparat von F. Kröhl in Allstedt (D. P. 17942; Fig. 248 auf folg. S.) wird aus einer Anzahl ausgehöhlter Scheiben gebildet, welche übereinander um eine mit Rührarmen versehene verticale Welle *B* angeordnet sind. Die hohlen Scheiben bestehen aus zwei Abteilungen, von denen die obere zur Aufnahme der zu kühlenden Maische, die untere zur Aufnahme der Kühlflüssigkeit dient. Letztere wird durch das spiralförmige Kühlrohr *F* emporgedrückt, tritt zunächst in den Hohlraum *G* unter dem Oberboden der untersten Scheibe und strömt von der Mitte nach der Peripherie der letzteren. Hier tritt es wieder in das Rohr *H* ein und geht in den Hohlraum *G* unter dem Oberboden der zweituntersten Scheibe u. s. w., bis es endlich aus dem Hohlraum *G* der obersten Scheibe heraustritt. Die zu kühlende Maische tritt aus dem Rohr *x* auf die oberste der Scheiben *A* und wird hier durch die Rührarme *C* in einer der Strömung des Kühlwassers entgegengesetzten

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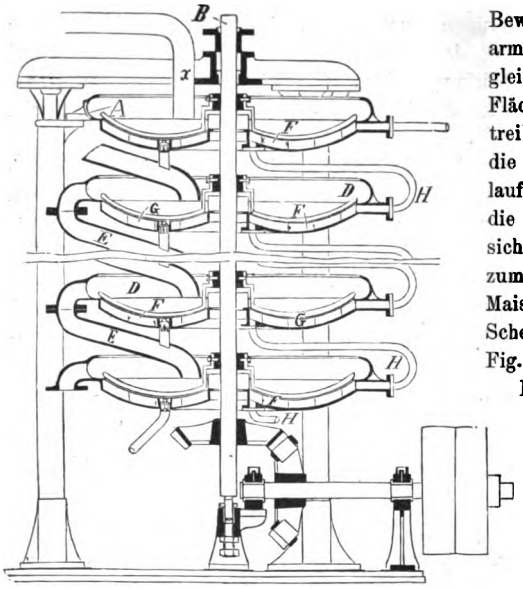
Fig. 248.



Richtung in eine rotirende Bewegung versetzt. Die Rührarme verteilen die Maische gleichmässig auf die obere Fläche der Scheiben und treiben sie dann in die um die Peripherie der Scheibe laufende Fangrinne *D*, an die das Ableitungsrohr *E* sich anschliesst, welches die zum rsten Male gekühlte Maische auf die zweite Scheibe von oben leitet u. s. f. Fig. 248.

Die Actienfabrik Landw. Maschinen in Regenwalde stellt den Vormaisch-Bottich mit doppeltem Boden und zum Teil mit doppelter Wandung her. Das den Hohlraum durchströmende Kühlwasser wird durch zwischen den Böden angeordnete Schaufelwerke in beständiger Bewegung gehalten. Nach dem Ausfluss aus diesem Hohlraum tritt das Kühlwasser in die Kühltaschen im Innern des Bottichs. (D. P. 19627.)

Maisch-Kühl- und Wärmeapparat von Charles Clinch in St. Davids Hill, Exeter. (D. P. 17651 vom 13. October 1881.) Innerhalb eines Gefässes mit der zu kühlenden Flüssigkeit wird ein aufrechter Cylinder angeordnet, der an den Enden geschlossen ist und eine grosse Anzahl verticaler Röhren von kleinem Durchmesser besitzt. Die Flüssigkeit im Behälter tritt in diese Röhren ein und der Raum um die Röhren im Cylinder oder der Trommel wird entweder mit kaltem Wasser oder mit Dampf gespeist, je nachdem die Flüssigkeit gekühlt oder erhitzt werden soll. Es wird unterhalb des Bodens des Cylinders ein Schraubenpropeller angeordnet, dessen Achse durch die Mitte geht. Die Flüssigkeit wird je nach der Richtung, in welcher die Schraube rotirt, entweder aufwärts oder abwärts getrieben. Um den Schraubenpropeller für die Hervorbringung einer verticalen Auf- und Abwärtsbewegung der Flüssigkeit wirksamer zu machen, wird er rund um seine Flügel mit einem Band oder Reifen versehen, welcher dieselbe Tiefe hat als die Flügel.

Der Kühlapparat von Adolf Dietsche in Waldshut (D. P. 18140 vom 20. November 1881) besteht im wesentlichen aus einem viereckigen Kasten mit verschiedenen Einlagen *a a a* (Fig. 249), parallel laufenden verzinnten Kupferröhren darin, die durch die an den Enden befindlichen Ge-

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häuse *b b* mit den Zwischenwänden *c c c* (Fig. 250) und entsprechenden Dichtungen eine vollständige Rohrleitung bilden. Die Röhren werden in der

Fig. 249.

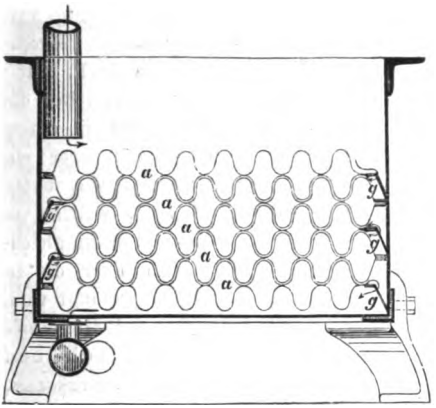
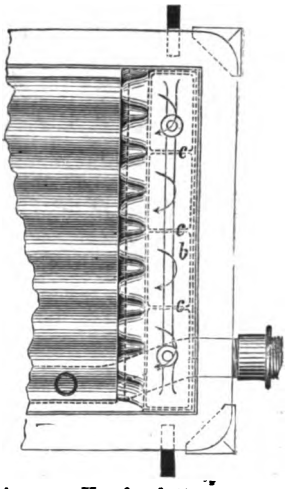


Fig. 250.



Weise hergestellt, dass zwei wellenförmige gebogene Kupferplatten so auf einander gelegt werden, dass Erhöhung auf Erhöhung liegt, worauf dieselben an der Berührungsstelle verlötet werden, so dass hierdurch gleichzeitig eine ganze Reihe parallel laufender Röhren entsteht. Diese Röhren liegen nun derart übereinander, dass zwischen je zweien der einzelnen zusammenhängenden Rohrreihen bezw. Einlagen eine schmale Spalte entsteht, die durch mehrere querüber laufende Erhöhungen in verschiedene Durchlassöffnungen für die zu kühlende Flüssigkeit zerfällt. Indem diese Röhreneinlagen bald auf der einen, bald auf der anderen der beiden Breitseiten des Kastens dicht anliegen, entsteht für den Durchlass der zu kühlenden Flüssigkeit ein breiter flacher Canal, welcher je nach Erfordernis durch eingelegte Filtersiebe *g g g* unterbrochen ist, und welcher durch die Erhöhungen resp. Wülste in vier gleichgrosse Canäle geteilt ist, die in ein gemeinschaftliches Abflussrohr einmünden. Zur Circulation des Kühlwassers dienen die durch die Zwischenwände *c c c* in Abteilungen geteilten Gebäuse *b*; jede Abteilung umfasst zwei Kühlrohre. Die Kühlung erfolgt nach dem Gegenstrom-Princip, indem das Kühlwasser den Apparat von unten nach oben, die zu kühlende Flüssigkeit von oben nach unten durchströmt.

Der Kühl- und Erwärmapparat von G. H. Walb in Alzey (D. P. 18070 vom 24. Mai 1881) besteht aus den nach unten an Grösse zunehmenden, doppelwandigen Behältern 1, 2, 3 etc., welche durch Gewindestücke und Streben untereinander und an dem Gestell befestigt sind. Die zu kühlende Flüssigkeit läuft aus der Schale *n* durch den Hahn über den Verteilungsstutzen *e* des ersten Behälters auf diesen und von dort über die

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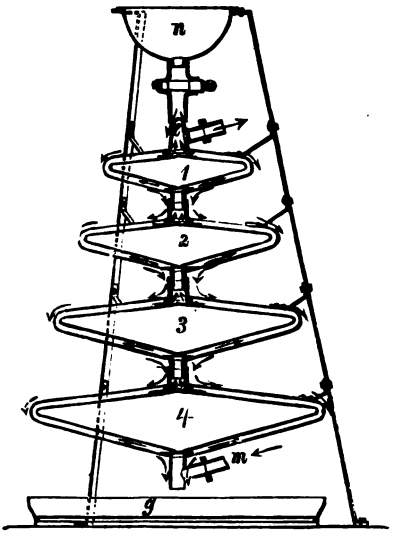
Fig. 251.



anderen Behälter bis in das Gefäss *g*. Das Kühlwasser tritt durch *m* ein, durchfliesst die Doppelwandungen der Behälter und tritt oben durch *e* aus dem Apparat. Fig. 251.

Georg Calberla in Hirschfeld bei Deutschenbora (D. P. 18157 vom 6. September 1881) leitet die zu kühlende Flüssigkeit in einem kastenförmigen Apparat über ein Blech, gegen welches von unten ein Wasserstral trifft, welcher so gerichtet ist, dass durch ihn gleichzeitig ein Luftstrom über die zu kühlende Flüssigkeit gesaugt wird.

Bei Versuchen mit Gontard's Verdunstungs-, Maisch- und Kühlbottich fand M. Stenglein, dass 1. die Kühlzeit $3^1/_4$ Stunden beträgt, eine Zeit, welche ältere Hampel'sche Wasserkühlbottiche häufig in Anspruch nehmen; 2. der Apparat die Maische ohne Zuhülfenahme von Wasser bis $13^1/_2°$ d. h. $2^1/_2°$ unter die Temperatur der Luft abkühlt. (Zeitschr. f. Spiritusind. 1882, No. 16, 332.)

Carl Pieper in Berlin (D. P. 19168 vom 25. Januar 1882) stellt zu besserer Reinigung die Kühltaschen an Vormaischbottichen und deren Kühlapparaten aus zwei Teilen her, welche durch eine leicht lösliche Schraubenverbindung zusammengehalten werden.

Delbrück giebt den kupfernen Kühltaschen vor den eisernen, besonders schmiedeeisernen den Vorzug, weil sie, obwohl teurer, eine grössere Kühlfähigkeit besitzen und auch bei jahrelangem Gebrauch blank bleiben. (Zeitschr. f. Spiritusind. 1882, No. 16, 333.)

Für die Verwendung von gusseisernen Taschen in Maisch- und Kühlapparaten, welche von H. Paucksch angefertigt waren, sprachen indess günstige Erfolge aus der Praxis. Nach genaueren physikalischen Untersuchungen von H. Paucksch jun. und Otto Reinke (Zeitschr. f. Spiritusind. 1883, 465) wurde bestätigt, dass eine Eisenplatte in gleicher Stärke wie eine Kupferplatte in gleicher Zeit gleiche Mengen Wärme von Wasser auf Wasser überzuleiten vermag; dasselbe gilt auch für Uebertragung der Wärme von Maische auf Wasser. Die Ersparnis an Kosten ist bedeutend, da Gusseisen wesentlich billiger ist als Kupfer.

Eine Concentration der Maische bei Verarbeitung stärkearmer Kartoffeln erreicht Delbrück durch Zugabe von Roggen, welcher vorher eingequellt und dann mit den Kartoffeln in der Weise in den Henze gebracht wird, dass eine Schicht Kartoffeln zu unterst, darauf der Roggen

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und dann der Rest Kartoffeln kommt und erst von oben mit gleichzeitigem Ablassen des Fruchtwassers, dann $1^1/_2$ Stunden bei $3^1/_2$ Atmosphären von unten gedämpft wird.

Eine höhere Saccharometeranzeige und grössere Ausbeute erhielt auch Wittelshöfer durch Zugabe von ausgewachsenem Winterroggen (2 Ctr. zu 48 Ctr. Kartoffeln) zu stärkearmer Kartoffelmaische in den Vormaischbottich. (Zeitschr. f. Spiritusind. 1882, 436.)

Beim Maischen von zum Mälzen nicht verwendbarer Gerste erhielt Francke durch vorheriges Aufkochen auf 40° R., 15stündiges Quellen, $^1/_2$stündiges Kochen bei offenem Mannloch und 1stündiges Kochen bei 3,5 bis 4 Atmosphären im Henze eine vollständige Aufschliessung des Kornes. (Zeitschr. f. Spiritusind. 1883, 12.)

Ein franz. Pat. erhielt F. Billet auf eine Methode, nach welcher Körnerfrüchte oder sonstige stärkehaltige Materialien mit 5proc. Salzsäure zur Lösung der Stärke unter Druck behandelt, in Holzbottichen verzuckert, nach der Neutralisation der Säure bis auf 0,75 gr. im Liter abgepresst und dann der Gährung überlassen wird, die so lebhaft ist, dass ein Teil der Hefe als Presshefe abgeschöpft werden kann.

Delbrück und Mittenzwey modificirten die Probenahme von Maischen dahin, dass das Filtriren in kupfernen bedeckten Cylindern stattfindet, wodurch Minderanzeigen bis zu 1,3 Proc. am Saccharometer sich ergaben, da auf diesem Wege die Verdunstung von Wasser und Alkohol verhindert wird. (Zeitschr. f. Spiritusind. 1882, 459.)

4. Gährung.

a) **Theorie der Gährung.** Die von Naegeli in seiner „Theorie der Gährung" ausgeführten und begründeten Anschauungen von der Gährung ausserhalb der Hefezellen sucht Ad. Mayer zu widerlegen; er schliesst dass weder eine Fernwirkung der Hefe durch unverletzte Zellwände nachzuweisen noch auch eine Beeinträchtigung der Thätigkeit eines Pilzes (z. B. Sprosspilzes) durch einen anderen (Spaltpilz) erfolge. (Zeitschr. f. Biologie XVIII. 522.) Naegeli erkennt an den Versuchen Mayer's verschiedene Fehlerquellen und kommt durch andere Interpretation von Mayer's Zahlen zu dem gerade entgegengesetzten Schluss, dass eine Concurrenz der Pilze untereinander sich bestätigt. (l. c. 543.)

Versuche über die Einwirkung der Luft auf Bierhefe wurden von Cochin ausgeführt. Bringt man gelüftete Hefe in Zuckerlösung, so dringt letztere einfach in die Hefezellen ein, das Resultat ist dasselbe, als wenn man die der Hefe entsprechende Menge Wasser zu der Zuckerlösung hinzugefügt hätte. Der Luft beraubte scheintodte Hefe nimmt dagegen aus der umgebenden Zuckerlösung so viel Zucker auf, dass der Procentgehalt der umgebenden Lösung sich sehr stark vermindert. Durch Aufkochen der Lösung lässt sich der von der Hefe absorbirte Zucker zum grössten Teil wiedergewinnen, der Rest war vergohren. Der Versuch beweist, dass die

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Umwandlung des Zuckers im Innern der Hefezellen stattfindet; die Luftentziehung befähigt die Zellen viel Zucker aufzuspeichern, wenn aber dann nicht Luft wieder zugeführt wird, so wird die Gährthätigkeit in den Zellen sehr bald wieder unterbrochen. Versuche über den Einfluss der Luft auf die Gärkraft der Hefe ergaben, dass gelüftete Hefe viel weniger Zucker in Alkohol umsetzt als normale, so dass man schliesslich dazu gelangen wird, dass eine Hefe, welche der Kraft Zucker durch Endosmose aufzunehmen beraubt ist, auch das Vermögen Zucker in Alkohol umzuwandeln verliert. Gelüftete Hefe oxydirt einen grossen Teil des Zuckers ohne Alkoholbildung. (Compt. rend. 1883, XCVI. 852.)

Leo Liebermann sucht darzuthun, dass der früher aufgestellte Unterschied zwischen geformten und ungeformten Fermenten bezüglich ihrer Wirkung und ihres Verhaltens nicht mehr festzuhalten ist, dass vielmehr in beiden Fällen ein chemisches Ferment wirksam wird. (Chem. Centralbl. XIV. 271 und 282.)

Aufmerksam gemacht durch die Bereitung von Chicha, einem alkoholischen Getränk, welches die Peruaner aus Maiskörnern herstellen, fand Marcano, dass in der Oberhaut des Maiskornes, dem Stengel und dem Inneren des Blattgewebes der Maispflanze ein Pilz vorkommt, welcher Mycelfäden, Kügelchen, ähnlich der Hefe und Vibrionen bildet. Diese sollen die Stärkekörner direct angreifen und nach Durchbohrung der Stärkecellulose (? Ref.) einem von ihnen gebildeten diastatischen Ferment Zutritt zur Granulose gestatten und somit die Möglichkeit der Umsetzung der letzteren geben. Um nachzuweisen, dass das Ferment wirklich von dem Vibrio gebildet wird, stellte Verf. verschiedene Versuche an, bei denen er den Pilz durch Chloroform tödtete und mit der so erhaltenen sterilisirten Flüssigkeit Stärke verzuckerte. Das Ferment erträgt Temperaturen bis zu 95°, die beste für seine Entwickelung liegt bei 40—45°. Es veranlasst Gärung in Mannit, Milch-, Rohr- und Traubenzucker. (Compt. rend. XCV. 345 und 856.)

E. Bauer fand, dass die Vergährung des Rohrzuckers einen schnelleren Verlauf nahm, wenn derselbe vorher mit Salzsäure invertirt und mit Kali die Säure neutralisirt war, als bei Vergährung nur mit Hefe, wo bei das in ihr enthaltene Invertin die Spaltung des Rohrzuckers in Dextrose und Levulose bewirken musste. Für das Vergären von Melassen lässt sich daher von dem vorherigen Invertiren eine günstige Wirkung erwarten. Wo zugleich aber Potaschegewinnung aus der Melasse stattfindet, würde die Ausbeute an kohlensaurem Kali beeinträchtigt. (Organ d. österr. Ver. f. Rübenzucker 1882, 305.)

E. Bauer fand die Dextranbildung (Melassengallerte) immer von Kugel- und Stäbchenbacterienvegetation begleitet. Zur Vergallertung einer Maische genügen oft Minuten; in der Melasse selbst fand sich nie Dextranbildung, trat jedoch oft beim Verdünnen der Melasse ein. Am lebhaftesten ist die Gallertbildung in neutralen Flüssigkeiten, geringer in schwach alka-

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lischen (0·112 Proc. Kalihydrat), kaum noch in stärker alkalischen (0·224 Proc.); garnicht tritt sie in sauren Flüssigkeiten auf. Durch Zusatz von Kalk, Soda oder Potasche zu den verdünnten Melassen oder Ansäuren mit Schwefelsäure ist sie also ganz hintanzuhalten. (Neue Zeitschr. Rübenzuckerind. 1882, 258.)

b) **Hefen- und Gährungsführung.** Wittelshöfer führt aus, dass, obwohl Theorie und Praxis lehren, dass je saurer das Hefengut ist, desto grösser die Sicherheit nicht saure Maischen zu bekommen, er doch durch Versuche, bei denen er saure und weniger saure Hefe nebeneinander führte, fand, dass nicht die Menge der Säure, sondern die Reinheit der Milchsäuregährung den Ausschlag giebt. (Zeitschr. f. Spiritusind. 1883, 286.)

Zur Selbsterziehung der Hefe beim Beginn der Campagne empfiehlt C. Werchau 15 kg grobgequetschtes Grünmalz mit der Abkochung von 0·25 kg Hopfen einzumaischen, bei 50° zu verzuckern, nach zwei Stunden von den Trebern abzuziehen und auf 19° zu kühlen. Nach 72 Stunden ist durch Selbstgährung brauchbare Hefe gewachsen, welche in verschlossenen Gefässen bei niederer Temperatur sich längere Zeit aufheben lässt. Der besonderen Beachtung wird empfohlen, die Einmaischtemperatur nicht unter 51° R., die Abstelltemperatur nicht unter 18—19° sinken zu lassen, da bei niedrigerer Temperatur mangelhafte Hefebildung stattfindet. (Zeitschr. f. Spiritusind. 1882, No. 14 S. 285.)

Nach Versuchen von M. Stenglein ist bei der Gährungsführung eine möglichst geringe Anstellungstemperatur der Maische einzuhalten und die Hefenmenge je nach der Concentration der Maische zu reguliren. Je saurer die Hefe, desto schneller soll sich die Maische während der Gährung erwärmen. (l. c. 1883, 4.)

K. Kruis fand bei Vergleichung des Schnellgähr-Verfahrens, wie es in Oesterreich üblich ist, bei Kartoffelmaischen höchstens 69 Proc. der theoretischen Ausbeute, während nach deutschem Verfahren bei mittlerem Betrieb 77 Proc., bei gutem 85 Proc. verlangt werden. Verf. fand, dass in den Maischen beim Schnellgähr-Verfahren $^3/_4$ des Dextringehaltes unvergoren blieben. Die Minderausbeute resultirt also bei diesem Verfahren daraus, dass das Dextrin bei der kurzen Gährzeit nur zum geringsten Teil in Zucker umgewandelt wird. (Oesterr.-ungar. Brenn.-Ztg. 1882.)

Die Schaumgährung ist, so giebt Stenglein an, mit Erfolg durch Zumaischen von Roggenschrot und Hafermalz bekämpft worden, auch Schwefelsäure und höheres Dämpfen bei dünner Maische waren von Erfolg. Wittelshöfer hat auch bisweilen durch Zumaischen von Roggen und höheres Dämpfen Erfolge gehabt, doch sind diese Mittel nicht zuverlässig. Ein Zusatz von Petroleum ($^1/_6$ l pro Bottich) verhindert zwar bei rechtzeitiger Zugabe die Schaumgährung, doch ist dieses Mittel verwerflich, da der Spiritus, welcher von solchen Maischen abgebrannt wird, die Manipulation erkennen lässt. (Zeitschr. f. Spiritusind. 1883, S. 307 u. 308.)

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V. Destillation und Rectification.

Bei dem Destillir-Apparat von Ostrowski in Posen (D. P. 18219 vom 20. August 1881) wird die Destillircolonne aus zwei aus Ringen zu-

Fig. 252.

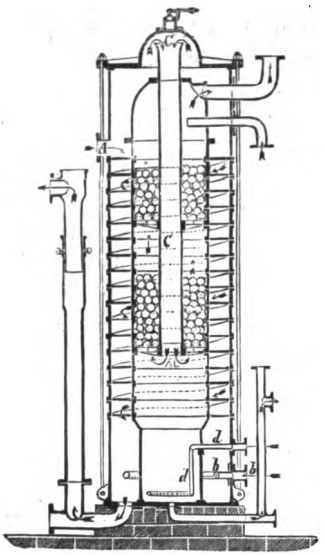
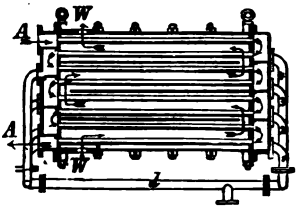


Fig. 253.



sammengesetzten gusseisernen Mänteln gebildet, die mit einander durch eine gewindeartige Fläche verbunden sind. Der innere Mantel bildet die Rectificircolonne. Die durch *A* zugeführte Maische durchläuft den spiralförmigen Kanal und wird durch den durch Rohr *b* zugeleiteten Dampf erwärmt. Die erzeugten Alkoholdämpfe strömen durch das centrale Rohr *C* nach unten und steigen durch zwei Schichten Glaskugeln, an denen sie die Beimengungen absetzen, nach oben, um von dort nach dem Condensator geleitet zu werden. Die von den Glaskugeln ablaufende Flüssigkeit wird noch einmal im Lutterraum durch Dampf vom Rohre *d* destillirt.

Der Condensator (Fig. 253) besteht aus einem aus fünf Teilen zusammengesetzten Kasten, in welchem acht Reihen Kupferrohre horizontal gelagert sind. Die Alkoholdämpfe treten in die oberste Reihe der Rohre, gelangen von diesen in einen seitlich angeordneten Kasten, durchströmen die zweite Reihe und so fort, bis sie unten angelangt, durch eine Oeffnung dem Kühler zugeführt werden. Das Kühlwasser fliesst in entgegengesetzter Richtung. Die in jeder Etage des Condensators condensirten schwächeren Teile sammeln sich in den entsprechenden Kammern und werden durch die Rohre *4, 3, 2, 1* einem gemeinschaftlichen Rohre *d* zugeführt, von welchem sie in die Rectificationscolonne zurückgeführt werden.

Die von Weigel in Neisse construirte Dephlegmations-Colonne (D. P. 20683 vom 8. Juni 1882) besteht aus dem Oberteil *A* und dem Unterteil *B*. Letzterer wird aus einer kupfernen Mantelzarge mit vier kupfernen Kapselböden *a* und drei Siebböden *b* gebildet. Der Oberteil *A* ist zusammengesetzt aus einer Anzahl Mantelzargenringe *c* und einem Boden- bezw. Halsteile *d*, aus den kupfernen Oberböden *e*, den Mittelböden *f* und den Unter-

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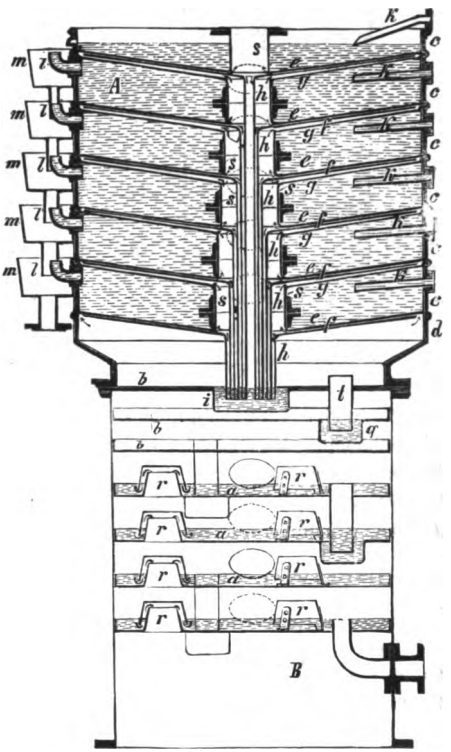
böden *g*. Zwischen je zwei Zargenringen *c* wird ein Mittelboden *f* zwischen einem Oberboden *e* und einem Unterboden *g* eingeschlossen gehalten. Von den Mittelböden *f* führt je ein Rohr *h* nach der in dem oberen Siebboden *b* des Unterteiles *B* befindlichen Lutterschüssel *i*. Die Rohre *h* der oberen Mittelböden sind teleskopartig in die der darunterliegenden Mittelböden eingesteckt. Ober- und Unterböden sind durch kupferne Stutzen *s*, auf welchen metallne Flantschenringe befestigt sind, mit einander verbunden.

Fig. 254.



Um die Dephegmation des Lutters etc. zu erreichen, wird in den inneren Raum jeder Abteilung von *A* durch die Rohre *k* Kühlwasser eingeführt, welches nach erfolgter Erwärmung durch die Kniee *l* in die Wasserfangkästen *m* abfliesst und von da abgeleitet wird. Die in der Apparatblase aus der Maische erzeugten, in den Unterteil eintretenden Alkoholdämpfe steigen durch die Kapseln *r* von Boden zu Boden, und nach Passirung der drei Siebböden *bb* in den Oberteil, wo dieselben den durch Pfeile angedeuteten Weg nehmen und teilweise dephlegmirt werden. Die reinen Alkoholdämpfe entweichen alsdann durch den oberen Stutzen *s* und werden durch ein Rohr dem Kühler zur endgültigen Condensirung und Spiritusbildung zugeführt. Die Dephlegmationsproducte werden aus jeder Abteilung des Oberteiles, isolirt durch die teleskopartig in einander gesteckten Rohre *hh*, dem Unterteil bezw. der Lutterschüssel *i* zugeführt.

Bei dem Brennapparat von W. Hagen in Soest (D. P. 20689 vom 28. Juni 1882) erfolgt die Entgeistung der Maische in ununterbrochenem Betriebe mittelst eines schnell rotirenden Stabsystems *O* und der concentrischen Kränze *N*, welchen die Maische durch einen rotirenden Teller *LM* zugeführt wird. Die Maische wird hierbei auf's feinste zerteilt und der aufsteigende Dampfstrom trifft mit allen Maischpartikelchen zusammen. Fig. 255.

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Fig. 255.

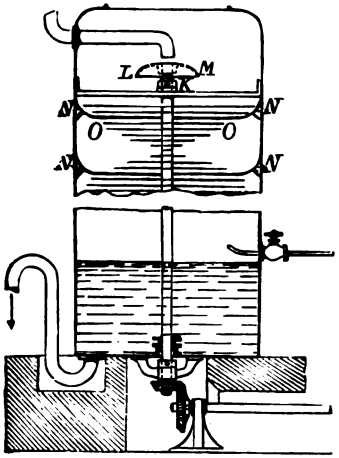
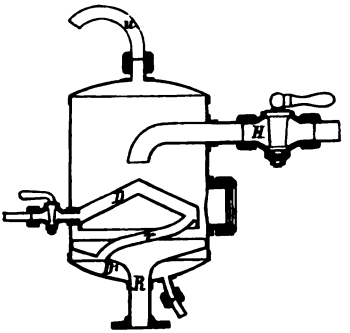


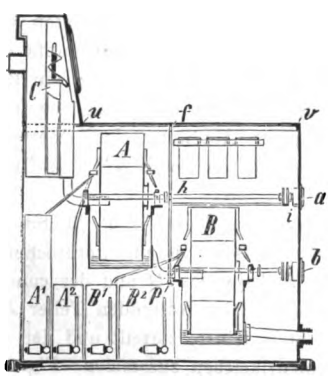
Fig. 256.



August Prenzler in Osnabrück. Apparat zur unmittelbaren Bestimmung des Alkoholgehaltes von Schlempe etc. während des Brenn- oder Destillationsprocesses. (D. P. 20662, 1882; Fig. 256.) Die kleinen Mengen der Rückstände, wie Schlempe, Lutterwasser etc. werden nur der indirecten Einwirkung des Wärmeträgers ausgesetzt. Der hierbei in Anwendung kommende Apparat besteht aus einem geschlossenen Behälter, indem sich die Heizräume *D* und *D'* zur Aufnahme des Wassersdampfes befinden. Dieselben stehen durch *r* miteinander in Verbindung. Die Schlempe fliesst durch Hahn *H* zu und durch *R* wieder ab. Die im Apparat entwickelten Dämpfe werden durch *s* in den Kühler geleitet.

Proben mit diesem Apparat, in Biesdorf von Delbrück ausgeführt, ergaben, dass derselbe den Abtrieb genau angiebt, dass er sich aber wegen zu enger Zuführungsöffnungen leicht verstopft. In Presshefefabriken, bei dünnerer Maische bewährte er sich vollkommen. (Zeitschr. f. Spiritusind. 1883, 311.)

Fig. 257.



Der Spiritus-Control- und Messapparat von Fritsche in Schönau bei Neutitschein (D. P. 21696 vom 1. August 1882) soll vermöge eines zweifachen, sich gegenseitig controlirenden Trommel- und Zählwerks der Steuerbehörde eine doppelte Sicherheit betreffs der Angaben sowohl über Maass als Qualität des producirten Spiritus geben und damit die Möglichkeit gewähren, den Fabrikbetrieb bei etwa vorkommenden Störungen im Apparat trotzdem ohne Verminderung der Sicherheit seiner Angaben fortdauern zu lassen. Der Apparat besteht aus dem

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Alkoholometerstand C, den beiden Messtrommeln A und B gewöhnlicher Construction, den beiden Zählwerken a und b, den Sammelgefässen für Controlspiritus A_1 A_2 B_1 B_2 und gestattet durch die Platten fp, hi, uv eine Isolirung der Trommeln und Zählwerke.

Seelig & Co. in Berlin haben den Deininger'schen Apparat verbessert. (D. P. 19752.)*) Die Cylinder CC^1 werden durch die verschliessbaren Oeffnungen ee^1 mit Chlorcalcium, die über diesen befindlichen Cylinder KK^1 mit Holzkohle gefüllt. Die Spiritusdämpfe aus dem Destillirapparat durch Rohr g in den Dreiweghahn h, den man so einstellen kann, dass die Dämpfe unter den Siebboden ab von C durch Rohr i oder unter den Siebboden von C^1 durch i^1 gelangen. Steigen sie z. B. durch ab, durch das in C befindliche Chlorcalcium sowie durch K, so gelangen sie durch k, den Dreiweghahn l und Rohr m rectificirt in den Kühler. Ist das Chlorcalcium in C mit Wasser gesättigt, so lässt man die Dämpfe durch Umstellen von h den zweiten Weg nehmen. Bevor das flüssige Chlorcalcium in C abgelassen wird, wird der in ihm enthaltene Alkohol dadurch aus demselben entfernt, dass man durch den Dampfhahn u und Rohr i Dampf in das Chlorcalcium eintreibt. Hierdurch verdampft der Alkohol und tritt durch $CKUupq$ in das Rohr i^1 des Cylinders C^1 und vereinigt sich mit den aus dem Destillirapparat kommenden Dämpfen. Statt dieses Verfahrens kann man das alkoholhaltige Chlorcalcium durch ein Rohr ablassen und durch Dampfrohr x und Ventil o in die untere Blase A Dampf einlassen und die entwickelten Alkoholdämpfe durch ein besonderes Rohr in die Maischcolonne zurückführen.

Fig. 258.

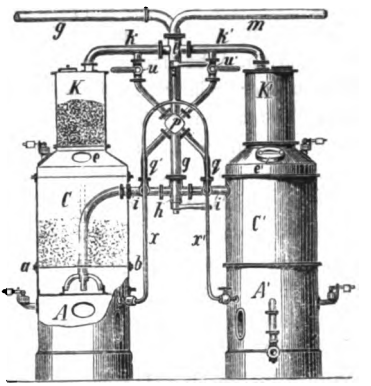
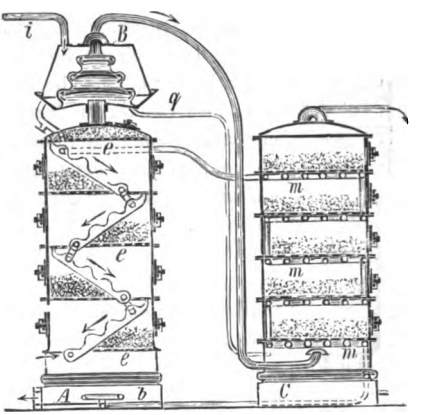


Fig. 259.



Konrad Trobach und Alfred Cords in Berlin haben an dem Verfahren von Deininger Neuerungen angebracht (D. P. 19517).*) Um den Alkohol der Maischen in reinem und concentrirtem Zustand zu gewinnen, werden Asbestfasern oder Asbest-

*) Techn.-chem. Jahrb. 1882, S. 297.

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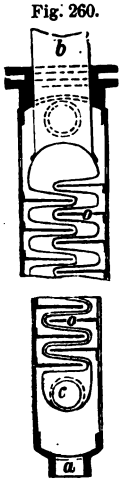
wolle angewendet, welche mit Chloriden, vorzugsweise mit Chlorbarium, behandelt ist. Der Apparat, Fig. 259 besteht aus der Maischcolonne *A*, dem Condensator bezw. Vorwärmer *B* und der Rectificationscolonne *C*. Nachdem der Apparat gefüllt ist, wird er durch die Dampfleitungen stark angeheizt, bis die darin auf den Siebböden *e* und *m* liegenden Präparate auf 60 bis 70° erhitzt sind. Darauf wird Maische dem als Vorwärmer dienenden Condensator *B* durch Rohr *i* zugeführt. Aus *B* fliesst dieselbe in der Richtung der Pfeile über die treppenförmigen Wellbleche langsam nach unten. Die Alkoholdämpfe bewegen sich in entgegengesetzter Richtung teils durch die Chlorbarium-Asbestlager, teils durch die Maische, bis sie entfuselt in den Condensator gelangen; die Schlempe sammelt sich im Behälter *b*. Die in dem Condensator nicht verdichteten Dämpfe gehen durch *q* in den Rectificator *C* und treten aus diesem in den Kühler. Die in dem Condensator verdichteten spiritushaltigen Wasserdämpfe laufen durch Rohr *q* in den mit einer Heizschlange versehenen Untersatz der Rectificationscolonne, um dort vollständig entgeistet zu werden.

Nach dem D. P. 20563 von Trobach und Cords werden die Fuselöle durch Natronhydrat, welches an Asbest oder Schlackenwolle oder Bimstein gebunden ist, gespalten. Um die noch vorhandenen Aldehyde zu zerstören, lässt man Dämpfe durch Schlackenwolle oder Asbest streichen, welcher mit Kalihydrat gemischt ist, so dass sich Aldehydharz bildet.

Um die mit Alkalien behandelte Rohspiritusdämpfe von dem widrigen Seifengeruch zu befreien, welchen sie bei dieser Behandlung annehmen, werden sie (nach dem D. P. 21967 von T. u. C.) einer Nachreinigung unter Anwendung von geglühtem Alaun, Braunstein und Zinkoxyd unterworfen. Der Braunstein soll dabei oxydirend, das Zinkoxyd neutralisirend wirken, die Wirkung des Alauns wird nicht näher erläutert.

Fig. 260.



Theisen in Leipzig hat Neuerungen an dem Lawrence'schen Kühlapparat angebracht (D. P. 20801).*) Der obere weitere Condensationsraum mündet direct in den unteren engeren Kühlraum. Die heissen Spiritusdämpfe treten bei *b* in den Condensationsraum, bei dessen Durchströmung sie condensirt werden; das Condensat fliesst in den unmittelbar sich anschliessenden Kühlraum, kühlt sich bei dem Durchströmen des letzteren ab und verlässt denselben bei *c*. Das Kühlwasser tritt bei *a* ein und strömt, dirigirt durch die Stege *o* in die Höhe und bei *d* ab.

Versuche, welche P. Wittelshöfer mit dem Theisen'schen Spirituskühler in der Versuchsbrennerei zu Biesdorf ausführte, ergaben einen Wasserverbrauch von durchschnittlich 3·66 l Wasser pro Liter Alkohol. Die Ausnutzung des Wassers war eine viel vollkommere, als bei dem Christoph'schen

*) Techn.-chem. Jahrb. 1883, S. 237.

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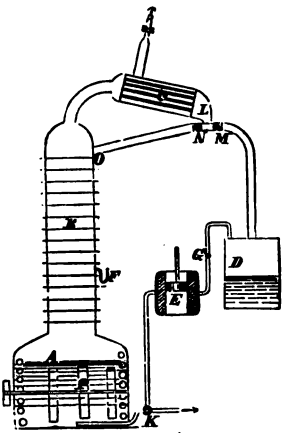
Apparat (dem einzigen, bei welchem Daten gesammelt waren), während sich beim Theisen von 290 dem Kühler zugeführten Wärmeeinheiten durch die Temperaturzunahme von 3·66 l Kühlwasser um 67·5° C. noch 247 Wärmeeinheiten nachweisen liessen, fanden sich beim Christoph von 267 bei einer Temperaturzunahme von 2·59 l Kühlwasser um 64·7° C. nur noch 167·6 Wärmeeinheiten. Der Verlust durch Strahlung etc. beträgt also im ersteren Falle 15 Proc., im letzteren 37 Proc. (Zeitschr. f. Spiritusind. 1882, No. 13, 267.)

Compagnie Industrielle des Procédés, Raoul Pictet in Paris. Rectificirung von Alkohol unter vermindertem Druck. (D. P. 16512 vom 21. Dec. 1880.)*) Nachdem ein gewisses Quantum Phlegma in den Kessel *A* gebracht ist, lässt man in dem Schlangenrohr lauwarmes Wasser oder einen Dampfstrom circuliren, um die Temperatur der Flüssigkeit auf 30 bis 40° C. zu bringen. Hierauf setzt man die Pumpe *E* in Thätigkeit. Dieselbe saugt die in dem Apparat befindliche atmosphärische Luft an, und nach Herstellung genügender Luftleere beginnt das Sieden der Flüssigkeit, wodurch alle Luft ausgetrieben und durch Wasser- und Alkoholdämpfe ersetzt wird, die dem Kessel entströmen. Da von diesem Augenblick an die Pumpe nur noch Alkohol und Wasserdämpfe ansaugt, kann man den Gang derselben durch Zustellen des Durchgangshahnes *G* zwischen der Saugleitung und dem Reservoir *D* abstellen oder mit Hilfe des Dreiweghahnes *K* eine directe Communication zwischen der Druckleitung der Pumpe und dem Kessel *A* herstellen, so dass die angesogenen Dämpfe nicht verloren gehen, sondern das Aufwellen der Kesselflüssigkeit bewirken. Sobald das Manometer *F* constant bleibt, kühlt man die Flüssigkeit, welche in der Condensationsvorlage *C* enthalten ist, ab. Zu diesem Zweck kann Schwefligsäureanhydrid zur Anwendung kommen, welches direct in das Innere der Rohrvorlage *C* eingeführt wird. Eine Pumpe saugt die Dämpfe desselben an, condensirt sie durch Druck in einem auf der Zeichnung nicht dargestellten Condensator, und die condensirte schweflige Säure fliesst durch eigenen Druck wieder in die Condensationsvorlage *C* zurück.

Fig. 261.



Die unter dem Einflusse des Druckes und der niederen Temperatur, welche in dem Apparat *C* erzeugt ist, condensirten Alkohol- und Wasserdämpfe fliessen in den unteren Teil *L*. Hier sind die Hähne *M* und *N* angebracht; *M* öffnet oder schliesst die Verbindung zwischen Condensationsvorlage *C* und Reservoir *D*; *N* dagegen zwischen *C* und dem oberen Teil

*) Techn. chem. Jahrb. 1883, S. 238.

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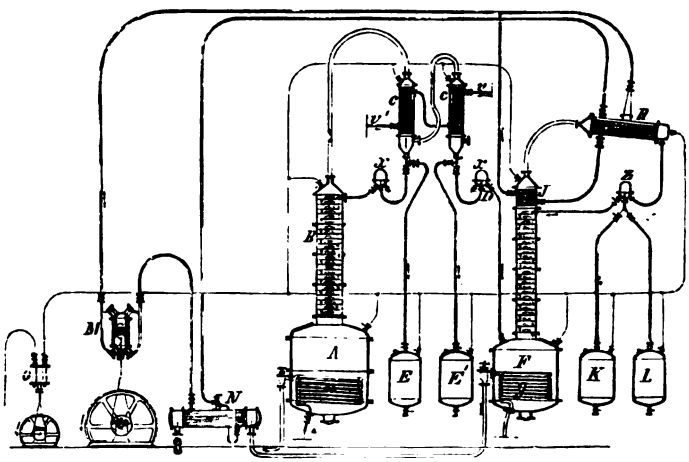
der Plattencolonne *B*. Beide Hähne werden dergestalt geöffnet, dass ungefähr die Hälfte des Condensats aus *C* durch Rohr *NO* nach *B* zurückfliesst, die andere Hälfte dagegen sich in das Reservoir *D* ergiesst. Infolge dieser Anordnung rectificirt sich der Alkohol mehr und mehr und nach einer gewissen Zeit zeigt der sich in das Reservoir *D* ergiessende Alkohol 96 bis 97° an. Um die Destillation zu befördern, ist in dem Kessel *A* ein Schaufelrad *P* angebracht, das durch Transmission in Drehung versetzt wird.

Nach dem Zusatzpatent 17826 ist der Apparat in folgender Weise zusammengesetzt: Der erste Rectificationskessel *A* wird durrh ein Schlangen-

Fig. 262.



rohr *u* geheizt, dem der Abdampf der Maschine zugeführt wird. *B* ist die erste Rectificationssäule, *CC*^{1} sind die zugehörigen Condensatoren, *EE*^{1} die Recipienten der Abgänge der ersten Rectification. *D* ist der Communicationshahn einander folgender Apparate. *v* und *v*^{1} sind Ein- und Auslass für das Condensationswasser, *xx*^{1} Probirapparate. *F* ist der Kessel der zweiten Rectification mit einem Schlangenrohr *y*, das vom Condensationswasser des Kühlapparates gespeist wird, *G* die zweite Rectificationssäule. *H* ist die Vorlage des Kühlapparates, gefüllt mit Schwefligsäureanhydrid. *J* eine kleine Vorlage mit gleicher Füllung. *K* ist der Recipient der guten Alkohole II. Qualität der zweiten Rectification, *L* der der Alkohole I. Qualität der zweiten Rectification. *z* ist ein Probirapparat, *M* die Pumpe des Kühlapparates, die durch einen hydraulischen oder einen Dampfmotor bewegt wird, *N* ist der mit Schwefligsäureanhydrid gefüllte Condensator des Kühlapparates, *O* eine doppeltwirkende Luftmaschine.

Die Destillirsäule von Claes & Raucq Frères in Brüssel (D. P. 19527 vom 24. December 1881) wird durch einen Boden gegen den Kessel abgeschlossen und steht mit diesem nur durch die Rohre *N* und *O* in Verbin-

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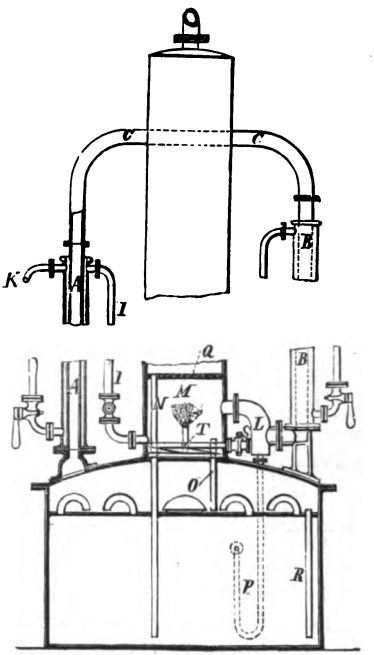
dung. Auf dem Kessel, mit diesem communicirend, ist das Rohr *A* angebracht, welches durch Rohr *C* mit dem nicht direct mit dem Kessel communicirenden Rohr *B* verbunden ist. *B* steht mit der Destillirsäule durch Rohr *L* in Verbindung, von dessen anderem Teil ein Steigrohr *P* nach dem Kessel führt und dessen oberer Teil in eine Dampfkammer *M* in die Destillirsäule mündet. Die Rohre *A* und *B* sind von Wasserkühlmänteln umgeben. Das Abflussrohr *I* des Kühlers um *A* mündet in die Dampfkammer *M*. Diese ist durch eine Siebplatte von der Destillirsäule getrennt. Die im Kessel entwickelten alkoholischen Dämpfe strömen durch *A C B L* in die Kammer *M*. Die während des Durchgangs durch Rohr *A* condensirten Dämpfe sinken in den Kessel zurück, das in *B* erhaltene Condensationsproduct gelangt durch *P* wieder in den Kessel. Die in *A* und *B* rectificirten Dämpfe werden in der Kammer *M* durch den Dampf des hier siedenden Wassers gewaschen und steigen dann durch Sieb *Q* in die Säule. (D. P. 19527).

Fig. 263.



Der Apparat zur Destillation unter Luftleere von N. Galland in Paris (D. P. 17972; Fig. 264, folg. S.) besteht aus einem Cylinder *CD*, welcher an beiden Enden geschlossen ist. Unter der durch die Mitte des Cylinders gehenden Welle *E* ist derselbe in verschiedene Abteilungen geteilt, welche abwechselnd einmal oben und einmal unten mit einander communiciren. Die Welle selbst ist mit Scheiben aus gelochtem Blech besetzt, welche bei ihrer Rotation die Maische in dünnen Schichten der Verdampfung aussetzen. In den einzelnen Abteilungen sind schlangenförmig gewundene Röhren angebracht. Der Vorwärmer *V* ist wie der Cylinder *CD* mit Verdampfungsscheiben *X* und einer Heizschlange *q* versehen. Er steht mit dem Cylinder durch die Rohre *GKV*^{1} in Verbindung, von denen ein Rohr nach *H* mit Pumpe *P*^{1} führt. Das Rohr *n* führt von *CD* nach dem „Analyseur" *L*, welcher aus einem Gefäss mit innerem Rohrsystem besteht. Derselbe wird auf einer constanten Temperatur erhalten. Von seinem Boden führt ein zweites Rohr nach *CL*. *L* ist durch Rohr *n*^{1} mit dem Condensator *M* dieser durch Rohr *n*^{11} mit dem Condensator *N* verbunden. Die Condensatoren sind mit den Gefässen *R* und *R*^{1} durch Rohrleitungen verbunden, in welche die Eprouvetten *1* und *2* und der Eiskasten *O* eingestellt sind. Roh-

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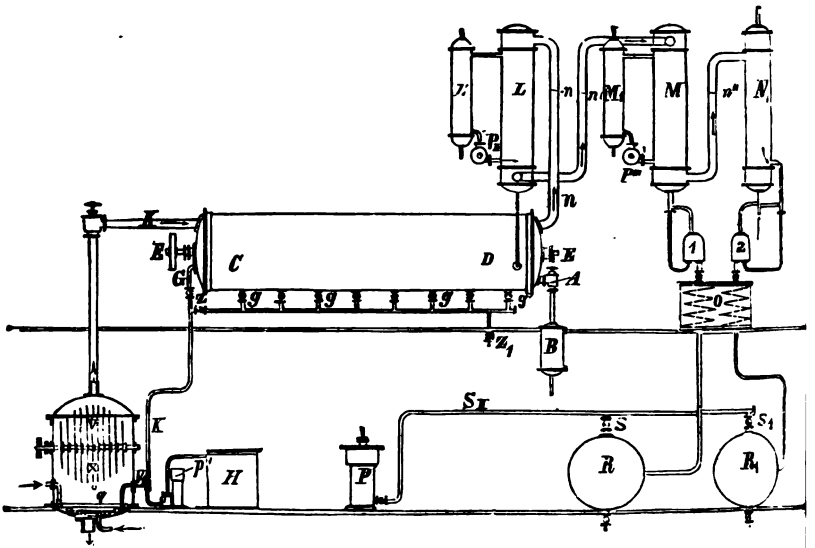
S^{II} verbindet R und R^1 mit der Luftpumpe P. Die „Calorisatoren" L_1 und M_1 sind Röhrenapparate mit Dampfzuleitungsrohren y; sie dienen dazu, die

Fig. 264.



Condensatoren auf einer bestimmten Temperatur zu erhalten. Mittelst der Pumpen P^{II} und P^{III} wird die Wassercirculation in den Röhren bewirkt.

Durch eine in CD erzeugte Luftleere wird die Maische aus den Gärbottichen angesaugt; sie geht durch den mit Warmwasser- oder Dampfheizung versehenen Anwärmer B und den Hahn A in den Cylinder CD und wird als entalkoholisirte Masse durch P^1 nach dem Reservoir gebracht. Der Dampf — directer, expandirter oder in V gebildeter — durchzieht CD in derjenigen der Maische entgegengesetzter Richtung und strömt, mit Alkohol geschwängert, durch n nach L. Hier werden die Wasserdämpfe und schweren Oele condensirt, welche nach der ersten Abteilung von CD zurücklaufen; die nicht condensirten Dämpfe gehen durch n^1 nach M, von wo der condensirte Alkohol durch Eprouvette *1* nach R fliesst, die nicht condensirten Dämpfe strömen durch n^{II} nach N und gelangen condensirt durch Eprouvette *2* nach R^1. Die in N nicht condensirten Dämpfe werden durch eine Pumpe abgesaugt und in einem Wasserreservoir niedergeschlagen.

Der Rectificationsapparat von Barbet in La Madelaine-lez-Lille setzt sich zusammen aus dem Phlegmenreiniger W und dem eigentlichen Rectificator Y. Jener besteht aus einer Anzahl durchlochter Kupferplatten und dem mit Heizschlange versehenen Raum A. Im Dome des Apparates werden durch den Plattencondensator B die Dämpfe getrennt. Die Aether gehen nach dem mit Wasser gekühlten Condensator C mit Rücklauf b und conden-

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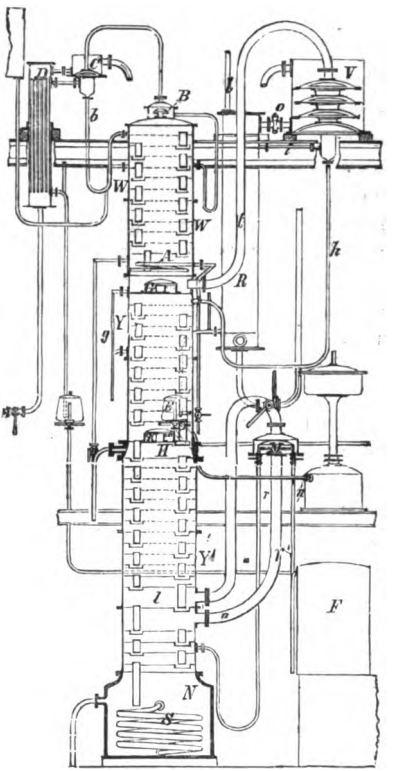
siren sich im Schlangen- oder Röhrenkühler *D*. Die in *A* angelangten Phlegmen werden durch die Schlange in *A* zum Sieden gebracht. In dem oberen Teil des Rectificators *Y* sind zwölf über einander liegende, mit Abflussrohren versehene Siebbleche angebracht, welche zur methodischen Trennung der alkoholischen Dämpfe dienen. Die Bleche erhalten ihren Zufluss nur durch die Rücklaufrohre *g* und *h*. Unterhalb der Bleche verbindet ein konischer Flantschenring *H* den unteren mit dem oberen Cylinder. Der untere Cylinder Y^1 trägt oben den Plattencondensator *K* und ist von dem untersten Teil durch eine volle Scheidewand *l* getrennt. Den Sockel des Apparates bildet der Kessel *N* mit der Schlange *S*. Der aus *N* aufsteigende Dampf wird, an Alkohol angereichert, zur Befreiung von öligen Nachproducten durch *u* nach dem Plattencondensator *M* geleitet. Von hier aus führt das Rohr *r* nach der vorletzten Platte des untersten Teiles und r^1 nach dem Behälter *F* für die fuseligen Producte. Durch n^1 treten die Dämpfe wieder in den Apparat über Platte *l*, durchstreichen die Destillirbleche, die Plattencondensatoren *K* und *G* und ziehen durch Rohr *t* in den Condensator *V*, welcher aus einer Reihe von übereinander liegenden Plattencondensatoren besteht. Die condensirte, wässerige Flüssigkeit wird durch Rücklauf *h* wieder in die Destillircolonne geführt. Durch *i* gelangen die Dämpfe nach dem Kühler *R*, und am Probeglas *E* erscheint der reine Alkohol. Durch *s* tritt das Kühlwasser nach *R* und fliesst durch *l* ab oder wird durch Hahn *o* in den Condensator *V* geleitet. (D. P. 17421 vom 12. Juni 1881.)

Fig. 265.



Naudin und Schneider in Paris (D. P. 17194) führen die Reinigung des Alkohols in einem Blechkessel mit durch Eisen oder Holzgitter gebildeten Abteilungen, welche elektrische, durch Niederschlag von Kupfer auf Zink hergestellte Metallpaare enthalten, aus. Der zu reinigende Alkohol wird in den Apparat unten eingeführt und durch eine Pumpe oben wieder abgesaugt. In einem zweiten Apparat wird in der mit Schwefel- oder Salzsäure ange-

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säuerten alkoholischen Flüssigkeit durch Anwendung von Elektricitätserzeugern Wasserstoff erzeugt. Die Säure wird später mit Eisen oder Zink sorgfältig neutralisirt und der Alkohol rectificirt.*)

R. Eisenmann in Berlin (D. P. 17924 vom 18. Juni 1881)*) beschickt jetzt zur Filtration des Rohspiritus die Filter mit porösem Eisen oder anderen porösen Metallen. Das Eisen wirkt als elektropositives Metall kräftig reducirend auf die Verunreinigungen des Rohspiritus, bindet aber auch dieselben vermöge seiner Porosität durch Absorption. Diese reinigende Kraft des Eisens wird vermehrt durch Verstärkung seiner elektropositiven Natur, indem derselbe mit dem negativen Pol einer galvanischen Batterie oder einer anderen Elektricitätsquelle in Verbindung gebracht wird. Nach Erschöpfung des Filtermaterials wird das verkupferte oder nicht verkupferte poröse Eisen nach vorhergegangener Waschung in einem kräftigen Dampfstrom von Neuem in eine Kupfervitriollösung getaucht, welche unter Vermehrung des Kupferniederschlages die verbrauchte Oberfläche des Eisens auflöst und dadurch die Regeneration bewirkt.

Nach dem D. P. 20144 sollen die Bohr-, Hobel- oder Drehspäne von Gusseisen in den Filtern selbst einer Reinigung unterworfen werden, indem man sie mit einer Lösung von übermangansaurem Kali behandelt. Hat sich diese durch Einwirkung des Eisens entfärbt, so wird so lange mit reinem Wasser ausgewaschen, bis der Ablauf nicht mehr alkalisch reagirt. Lässt die Wirkung des porösen Eisens auf den Spiritus mit der Zeit etwas nach und zeigt sich von Neuem die Bildung übelriechender Substanzen, so kann das Eisen durch Wiederholung obiger Behandlung regenerirt werden.

Zur Reinigung von Roh-Alkoholen, insbesondere Zuckerrüben-Alkoholen, wendet Farnham Maxwell Lyte in London (D. P. 20797 vom 9. Juli 1882) die Superoxyde des Bleis, Wasserstoffs, Bariums, Strontiums oder Calciums an. Besonders wird das auf nassem Wege dargestellte feuchte Bleisuperoxyd empfohlen. Dasselbe wirkt stark oxydirend auf die Amine (Trimethylamin) und die Aldehyde, während der Aethylalkohol kaum davon angegriffen wird. Die Reinigung des Spiritus wird entweder in der Kälte ausgeführt, wobei zwar längere Zeit erforderlich, die Wirkung aber eine vollkommere ist, oder der Spiritus wird über dem erforderlichen Quantum Bleisuperoxyd abdestillirt.

A. Schrohe teilt eine Tabelle über die Grösse der Schwindung von 50procentigem Branntwein beim Fasslager mit. (Zeitschr. f. Spiritusind. 1882, 365.)

6. Untersuchung von Spiritus.

Den Alkoholgehalt weingeistiger Flüssigkeiten bestimmt Devige (Bordeaux), indem er ein bestimmtes Volum davon abdestillirt und mitsamt dem Gefäss, welches das Destillat enthält, an den einen Arm einer Waage befestigt, deren anderer Arm eine Teilung trägt, an der mittelst eines

*) Techn.-chem. Jahrb. 1883, S. 238.

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Laufgewichtes der Alkoholgehalt direct abgelassen werden kann. (Engl. Patent 250, 1882)

Den qualitativen Nachweis, sowie die quantitative Bestimmung des Fuselöls führt L. Marquardt aus durch Ausschütteln des Branntweines mit Chloroform, Entfernen der letzten Reste von Aethylalkohol durch Ausschütteln mit Wasser, Oxydation des Fuselöls in der Chloroformlösung mit chromsaurem Kali und Schwefelsäure, Abdestilliren der gebildeten Valeriansäure, Digeriren mit kohlensaurem Baryt und Feststellung des Gehaltes von Chlor und Barium im Filtrat; durch Subtraction des als Chlorbarium vorhandenen Baryts von der Gesamtmenge desselben ergiebt sich die Menge des an Valeriansäure gebundenen Baryts und daraus der Amylalkoholgehalt, wenn man für ein Aequivalent Baryt zwei Moleküle Amylalkohol rechnet. Für den qualitativen Nachweis genügt die Constatirung des Valeriansäuregeruches, der selbst den des Kümmelöls übertönt. (D. chem. Ges. 1882, No. 10 und 12.)

Le Bel wies in Wein und Bier Amylalkohol nach. Die Mengen, welche bei der Gährung dieser natürlichen Zuckersäfte entstehen, sind grösser als diejenigen, welche sich beim Vergähren von Rohrzucker bildeten. (Compt. rend. 96, S. 1368.)

Hattinger fand in käuflichem Amylalkohol Pyridin oder ähnliche basische Körper. (Industriebl. 1883, 1.)

H. Gal fand, dass nicht immer, wie frühere Versuche von Sömmering, Liebig und Longet ergeben hatten, beim Aufbewahren von Mischungen von Alkohol und Wasser in tierischer Blase eine Vermehrung des Alkoholgehaltes der in der tierischen Flüssigkeit bei der Diffusion zurückbleibenden Flüssigkeit eintrat, sondern dass dies nur der Fall ist, wenn die umgebende Luft trocken ist, dass dagegen bei mit Feuchtigkeit gesättigter äusserer Luft eine Verdünnung des Residuums an Alkohol eintritt. Die Temperatur und die Dicke der Membran sind auf dieses Resultat ohne Einfluss, nur wächst mit steigender Temperatur und dem Dünnerwerden der Membran die Schnelligkeit der Diffusion. (Compt. rend. 1882, 95 S. 844 und 1883, 96, S. 338.)

7. Rückstände der Spiritusbereitung.

Märcker berichtet über Versuche von Schmöger und Hesse, welche nachweisen, dass Kartoffelschlempe gegenüber einer Fütterung von ähnlichem Nährstoffgehalt eine erhebliche Mehrproduction von Milch bewirkt, ohne die Zusammensetzung letzterer ungünstig zu beeinflussen. Die Maisschlempe ist ein specifisch milcherzeugendes Futtermittel. (Zeitschr. f. Spiritusind. 1883, 450.)

Durch Calculationen über den Wert der Schlempe-Eintrocknungsverfahren kommt Märcker zu dem Schluss, dass es nur bei sehr niedrigen Roggen- und höheren Spirituspreisen rentiren wird, die Schlempe einzudicken, dass aber unter mittleren Verhältnissen von dem Eindicken der Mais- und

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Kartoffelschlempe ein sehr annehmbarer Gewinn zu erwarten steht. (l. c. S. 471, 490 und 509.)

8. Statistik.

Zahl und Betriebseinrichtung der im Reichssteuergebiet vorhandenen Brennereien nach dem Stande am Schlusse des Etatsjahres 1881/82.

Termine bezw. Bezirke der Directivbehörden.	Zahl der vorhandenen Brennereien.	Darunter Brennereien, welche nach Maassgabe ihrer Einrichtung									
		a) mittelst einer Destillation Branntwein bereiten:						b) die Branntweinbereitung nicht in einer Destillation beenden:			
		zu 80 Proc. nach Tralles und mehr.	unter 80 Proc.	Zusammen.	Hierunter (Sp. 5) mit continuirlichem Apparat.	Hierunter (Sp. 5) mit Blase und mit Dampfapparat.	Hierunter (Sp. 5) mit Blase und ohne Dampfapparat.	mit Maisch oder Vorwärmer.	ohne Maisch oder Vorwärmer.	Zusammen.	Hierunter (Sp. 11) mit besonderer Rectificirblase.
1	2	3	4	5	6	7	8	9	10	11	12
Prov. Ostpreussen.	401	345	55	400	22	378	—	—	1	1	—
„ Westpreussen	257	255	2	257	122	133	2	—	—	—	—
„ Brandenburg	636	572	6	578	260	313	5	12	46	58	22
„ Pommern . .	357	345	2	347	125	221	1	9	1	10	8
„ Posen	426	424	—	424	153	271	—	1	1	2	1
„ Schlesien . .	1 083	665	23	688	117	557	14	79	316	395	23
„ Sachsen . . .	400	291	21	312	78	229	5	74	14	88	43
Uebrige preuss. Directivbezirke . .	5 018	45	337	382	73	264	45	1 355	3 281	4 636	931
Zusammen preuss. Directivbezirke	8 578	2 942	446	3 388	950	2 366	72	1 530	3 660	5 190	1 028
Königr. Sachsen .	708	673	18	691	16	667	8	11	6	17	1
Hessen	773	5	313	318	18	247	53	229	226	455	54
Thüringen und Anhalt	137	104	17	121	15	104	2	11	5	16	1
Mecklenburg, Oldenburg, Braunschweig	144	71	13	84	27	57	—	47	13	60	23
Elsass-Lothringen.	29 883	4	45	49	18	25	6	52	29 782	29 834	94

Die gesamte Alkoholproduction Frankreichs im Jahre 1882 stellte sich (nach Stat. Corresp. No. 21, Bulletin de statistique et de législation comparée) auf 1 766 566 hl. Hiernach kommen ferner auf die einzelnen Zweige: aus mehligen Substanzen und Kartoffeln 447 066 hl, aus in- und ausländischen bezw. aus den Colonien eingeführter Melasse 703 989 hl, aus Zuckerrüben 556 056 hl, aus Wein, Weintrestern, Cider und Früchten 55 397 hl, aus anderen Substanzen 4 058 hl.

9. Presshefefabrikation.

G. Francke zieht das Anstellen der Presshefenmaische mit Presshefe vor vom theoretischen Standpunkte aus, da mit der Presshefe nur wenige Kugelbacterien in die Maische gelangen und genau abgemessene

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Quantitäten Hefe verwendet werden können. Für die Praxis hält er jedoch z. Z. die Verwendung der Kunsthefe für richtiger, da sie billiger ist, obwohl aus ihrer Bereitungsart, bei mangelhafter Vorsicht, grosse Gefahren für die Maische entstehen können. Die günstigste Temperatur zum Anstellen der Kunsthefe ist die von 19—20° R. bei der Presshefenfabrikation; das Anstellen geschieht besser mit Presshefe als mit Mutterhefe. Der geeignetste Zeitpunkt für die Verwendung der Kunsthefe ist der, wo die Tochterzelle die gleiche Grösse wie die Mutterzelle erreicht hat und sich in kurzer Zeit abtrennen wird; dieser fällt gewöhnlich mit dem Moment zusammen, in dem die Kunsthefe knapp über die Hälfte vergohren ist. Bei der directen Anstellung der Presshefenmaische mit Presshefe empfiehlt sich ein vorheriges Behandeln derselben mit Schwefelsäure von etwa $^1/_2$—1 Proc., wobei jedoch darauf zu achten ist, dass dieselbe nicht zu lange mit dieser concentrirten Lösung in Berührung bleibt. (Zeitschr. f. Spiritusind. 1883, 221.)

Wiedrinc (Moskau) empfiehlt die Anstellhefe alle 8 Tage zu wechseln, wodurch ein gleichmässigeres Product erzielt wird. Die Ausbeute der ersten Tage fällt dabei allerdings etwas geringer aus. (l. c. 1883, 71.)

Wehmer in Hankensbüttel. Presshefegewinnung. (D. P. 18569 vom 26. November 1881). Für 1000 l Bottichraum werden 400 kg rohgeriebene Kartoffeln derart verarbeitet, dass deren Brei, in den mit 200 l kalten Wassers angefüllten Vormaischbottich geschüttet, bis 40° R. angekocht wird. Alsdann werden 30 kg Grünmalz gequetscht und $37^1/_2$ kg Roggenschrot zugesetzt. Die Masse wird mit Wasser bei 45° R. angekocht. Es werden entweder im Vormaischbottich 3 l kalte, klare Schlempe beigegeben, die Masse erhitzt bis auf $49^1/_2$° R. und $1^1/_2$ Stunde zur Verzuckerung stehen gelassen, alsdann nach dem Kühlschiff gebracht und bei 20° R. in den Gährbottich gelassen oder es werden der Maische auf dem Kühlschiff bei 32° R. 5 l kalte Schlempe zugesetzt. Zur Gährung werden im ersten Falle 2 kg frische Presshefe im Gährbottich zugesetzt, im anderen Falle gewöhnliche Grünmalzhefe, welche mit 1 kg Presshefe angestellt wird.

Burow in Preetz maischt das Hefengut zwei Tage vor dem Verbrauch mit so viel Wasser von 50° R. ein, dass eine Concentration von 15 Proc. Zucker erlangt wird. Nach beendeter Verzuckerung wird das Hefengut der Säuerung überlassen, bis ein Säuregehalt von 2 bis 2·2 Proc. eingetreten ist darauf erforderlichenfalls abgekühlt und am dritten Tage 6 bis 7 Stunden vor dem Verbrauch mit $2^1/_2$ kg stärkefreier Presshefe bei 19—20° R. unter Zugabe von 100 cbcm Schwefelsäure abgestellt. Ist die Vergährung bis auf die Hälfte des Zuckergehaltes erfolgt, wobei der Säuregehalt um 0·5 Proc. zugenommen haben muss, so wird das Hefengut mit 25 l 24- bis 25grädiger Maische vorgestellt und dann nach $^1/_2$stündigem Gähren der Hauptmaische unter nochmaliger Zugabe von 200 cbcm Schwefelsäure zugegeben. Zur Herstellung der Hauptmaische werden 300 kg Kartoffeln und 100 kg feingeschrotener Mais mit 600 l Wasser zum Sieden erhitzt. Während dieser Zeit werden 70 kg zerkleinertes Grünmalz, 100 kg geschrotenem Roggen und

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30 kg Buchweizen eingemaischt. Das gesamte Maischmaterial kommt in Vormaischbottich und wird bei einer Temperatur von 50° R. gar eingemaischt. Darauf bleibt die Maische eine halbe Stunde zur Verzuckerung stehen und wird dann gekühlt. Nach beendeter Kühlung wird die Maische in den Gährbottich übergeführt, das Hefengut zugegeben und bei 19 bis 20° R. abgestellt. Der Zuckergehalt der abgestellten Maische muss 11·5 bis 12·5 Proc., der Säuregehalt 0·4 bis 0·5 Proc. betragen. (D. P. 18575.)

A. Schrohe hebt hervor, dass bei Benutzung von geklärter Schlempe zur Presshefefabrikation ein Hauptaugenmerk darauf zu richten sei, dass das Eindringen von Pilzsporen während des Klärens und Kühlens vermieden wird. Verfasser will das Klären deshalb in verschlossenen Klärbottichen in 36 bis 48 Stunden mit 40 bis 50 Proc. Ausbeute an klarer Schlempe und die Kühlung nicht auf Kühlschiffen, sondern in besonderen Kühlvorrichtungen vorgenommen wissen. Der Wert des Schlempezusatzes ist in ihrem Gehalt an Milchsäure und deren peptonisirender Wirkung zu suchen. (Zeitschr. f. Spiritusind. 1882, 265.)

Francke berichtet über eine Vorrichtung am Hefekühler, deren besonderer Vorteil darin besteht, dass die Kühlschlange nicht fest im Hefengefäss steht, sondern durch eine Hebelvorrichtung gehoben und gesenkt werden kann. (l. c. 1883, 87.)

Zur Bestimmung der Gährkraft der Hefe (besonders für vergleichende Versuche) hat Billet (Marly-les-Valenciennes) einen Apparat „Levuro-Dynamomètre“ construirt, welcher die Form einer Aräometer-Spindel hat, deren Scalenrohr oben in einen Trichter erweitert ist. In diese Spindel werden 50 cbcm einer Rohrzuckernährlösung und 5 g mit 20 cbcm Wasser aufgeschlemmter Hefe gebracht, dieselbe in einen Cylinder mit Wasser von 30° C. eingetaucht und Wasser zugegeben, bis sie zu dem Nullpunkt einer an dem engen Rohr angebrachten Teilung eintaucht (jeder Strich der Teilung entspricht 0·782 g Kohlensäure). In dem Mässe wie die Gärung vorschreitet und Kohlensäure entweicht, wird die Spindel sich heben. (l. c. 1883, 37.)

G. Heinzelmann fand bei Versuchen über die Wirkung der Salicylsäure auf die Gährkraft der Presshefe, dass ein Zusatz von 0·15 g auf 400 cbcm Zuckerlösung die Hefe tödtete, dass aber durch geringe Zusätze die Gährkraft gehoben wird und bei Zusatz von 0.1 Proc. am grössten ist. Die Bestimmung der Gährkraft geschah nach Hayduck*). Ferner fand Verf. dass ein Zusatz von 1·0 g Salicylsäure auch fördernd auf die Alkoholbildung wirkt, was besonders in Zuckerlösungen im kleinen deutlich hervortrat, ein weniger günstiges Resultat zeigten die Versuche mit Maischen. (l. c. 1882, 458.)

*) Techn.-chem. Jahrb. 1883, S. 226.

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XXVI. Fette Oele und Fette.

1. Fette Oele und Fette.

Die Industrie der Fett- und Oelgewinnung hat im verflossenen Jahre wenig Neuerungen aufzuweisen. Für Oelpressen sind zwei Patente zu erwähnen.

Bei der Presse von Osc. Schneider in Cöln (D. P. 18907 vom 15. November 1881) ist an dem äusseren, oben offenen Kasten *H* (Fig. 266) die Thür *T* angebracht, welche durch den Keil *R* oder die Vorrichtung *v* verschlossen werden kann. Seine beiden Seitenwände *a* und *b* sind mit senkrechten Nuten oder schmalen Rinnen versehen, ebenfalls der Boden, während die anderen Seitenwände *c* und *d* glatte Oberflächen besitzen. In der hinteren Wand befindet sich am Boden für den Oelabfluss eine Oeffnung. Der schubladenartig einzuschiebende Einsatzkasten (Fig. 267) besteht aus dem an einer Seite vorspringenden Boden β und den Seitenwänden *ghi* und *k*, von welchen die beiden stärkeren *g* und *h* mit senkrechten Nuten oder Rinnen versehen sind; die ihnen gegenüberstehenden, mit den genuteten Wänden des Hauptkastens correspondirenden schwächeren Seitenwände *i* und *k* haben glatte Oberfläche. Sämtliche Seitenwände sind mit kleinen, der Boden mit grossen und kleinen Oeffnungen versehen. Bei *g* und *h* correspondiren dieselben mit in diesen Wänden vorhandenen äusseren Nuten und bei *i* und *k* mit den in den Wänden *a* und *b* angebrachten inneren Rinnen. Die mit einander fest verbundenen Wände *g* und *h* sind auf den Boden β befestigt, während die beiden anderen Wände *i* und *k* sich um Scharniere drehen lassen. Um diese beiden Wände beim Füllen unter einander zu verbinden, ist auf der Wand *i* ein Winkel befestigt, durch welchen vermittelst eines Stiftes die Wand *k* mit *i* verbunden werden kann. Der Keil *R* dient im Verein mit einer Führungsleiste am äusseren Kasten zur Befestigung des Einsatzkastens in dem Hauptkasten.

Fig. 266.

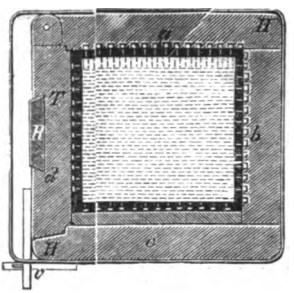
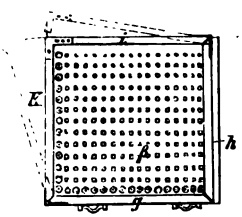


Fig. 267.



P. Dubard Brenot fils und E. Dubard Brenot fils in Paris ersetzen die für für Oelpressen bestimmten Presstücher durch einen Metallkorb (D. P. 20692 vom 4. Juli 1882), dessen einzelne Wandungen aus T-Eisen unter Belassung von Spalten gebildet werden. Die eine Wand lässt sich thürartig schliessen, indem das mit dem keilförmigen Ansatz *K* (Fig. 268) versehene

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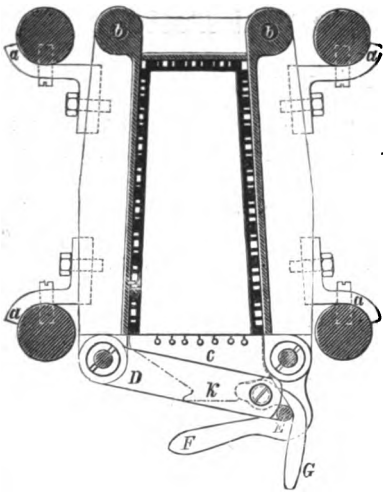
Fig. 268.



Verschlussstück *C* von dem zweiten Stück *D* angedrückt und mittelst der Haken *G* und *F* sowie der senkrecht eingesteckten Stange *E* festgehalten wird. Der Metallkorb stützt sich mit seinen Armen *a* auf die in die Säulen eingeschraubten Bolzen.

Das Extractionsverfahren hat in neuerer Zeit vielfach Verwendung gefunden zur Extraction von Knochen. Ueber die verschiedenen Methoden, welche in dieser Hinsicht zur Verwendung gekommen sind, wurde in der Generalversammlung deutscher Düngerfabrikanten am 1. Juni v. J. in Hannover verhandelt. Die chemische Fabrik „Silesia" hatte ursprünglich das Seltsam'sche*) Verfahren zur Anwendung gebracht, dabei aber schlechten Leim erhalten und deshalb das Verfahren wieder eingestellt. Dies hatte Richters**) bewogen, einen Apparat zu construiren, welcher der Leimgewinnung mehr entsprach. Als Vorteile des letzteren Verfahrens gegenüber dem Seltsam'schen wurde in der Versammlung angeführt:

1. dass das Benzin nicht vor dem Mannloche steht, wo es leicht bei irgend einer Undichtigkeit entweichen und feuergefährlich werden kann;
2. dass im Interesse der Leimfabrikation ein Dampfdruck auf die Knochen vermieden wird;
3. dass in dem Doppelapparate die Knochen gleich gedämpft werden können;
4. dass die Operation kürzere Zeit in Anspruch nimmt und
5. dass die Patentgebühr wesentlich niedriger ist.

Demgegenüber bestritt Seltsam, dass der grössere oder geringere Druck in dem Apparat auf die Beschaffenheit des Leimes von Einfluss sei. Nur die Höhe der Temperatur komme dabei in Betracht und diese übersteige bei seinem Verfahren nicht 80 bis 100° C.

Auch Dr. Michel (Ludwigshafen) bestätigt, dass er mit dem Seltsam'schen Verfahren sehr zufriedenstellende Resultate erziele und deshalb die Patentgebühr nicht zu hoch finde. Seine Fettausbeute betrage $6^1/_2$ bis $8^1/_2$ Proc. und ausserdem sei das Knochenfett wesentlich besser als früher.

Wenn es nun keinem Zweifel unterliegt, dass man bei dem Extractionsverfahren mehr Fett aus den Knochen gewinnt, als beim Auskochen mit Wasser und auch die Arbeit rascher von Statten geht, so haftet demselben

*) Techn.-chem. Jahrb. 1881, S. 241.
Techn.-chem. Jahrb. 1883, S. 244.

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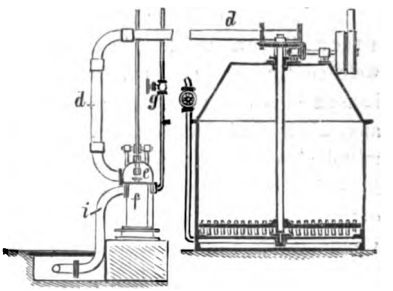
doch ein sehr grosser Uebelstand an, das ist der üble Geruch, welchen das extrahirte Knochenfett zeigt und der es zur Seifenfabrikation fast unbrauchbar macht. So lange man nicht im Stande ist, dem extrahirten Knochenfett den unangenehmen Geruch zu nehmen, wird es einen erheblich geringeren Wert haben, als das ausgekochte.

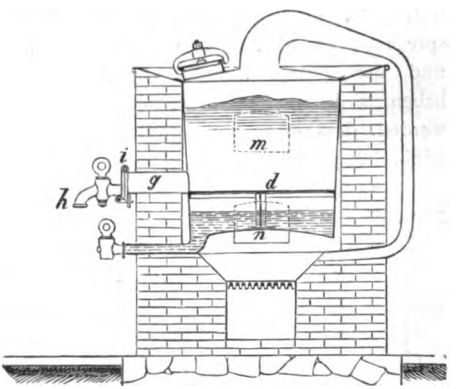
Carl Müller & Co. in Stuttgart haben sich den in Fig. 269 abgebildeten Apparat zum Schmelzen von Rohtalg und den Rückständen von der Margarintalgschmelze unter Gewinnung von Talggrieben patentiren lassen, wobei eine Belästigung der Nachbarschaft nicht vorkommen soll. (D. P. 19783 vom 25. Februar 1882.) Die übelriechenden Dämpfe, welche während des Betriebes in den durch eine Haube geschlossenen Kesseln sich bilden, werden von der Luftpumpe *ff* durch die Röhrenleitung *d* in den Luftkessel *e* gesaugt, woselbst sie durch Einspritzen von kaltem Wasser aus *g* vollständig condensirt und als klares Wasser durch die Röhrenleitung *i* in den Abzugscanal abgeführt werden.

Fig. 269.



F. Joseph Kurz in Würzburg hat sich ebenfalls einen Apparat zum Fettschmelzen auf geruchlosem Wege patentiren lassen. (D. P. 21291 vom 25. Mai 1882.) Das Fett kommt auf den Senkboden *d*, unter diesem befindet sich Wasser. Die Feuergase werden zunächst durch *m* abgeleitet, so dass nicht nur der mit Wasser, sondern auch der mit Fett gefüllte Teil davon bestrichen wird, später werden sie durch *n* abgeleitet, so dass dann nur mittelst Dampfes geschmolzen wird. Am Kessel sitzt ein Rohr *g*, welches durch einen Deckel *i* verschlossen ist; an *i* sitzt der Hahn *h*. Bei entsprechend gewählter Wassermenge lässt sich *h* alles Fett abziehen, andererseits lassen sich beim Aufklappen von *i* die abgetrockneten Grieben mittelst Krücke bequem herausziehen.

Fig. 270.



Unter den vielen Versuchen, immer mehr Fette für Zwecke der Ernährung brauchbar zu machen, verdient Beachtung das Paul Jeserich und C. A. Meinert-Bünau in Berlin patentirte Verfahren, rohe Pflanzenfette für die Kunstbutterfabrikation tauglich zu machen (D. P. 19819). Die

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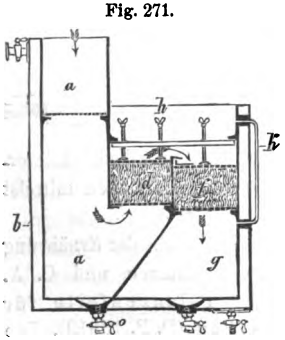
rohen Pflanzenfette (Cocosöl, Palmkernöl etc.) werden mit überhitztem Wasserdampfe behandelt und sodann zur Verseifung etwa vorhandener freier Fettsäuren mit 0·25 Proc. gebrannter Magnesia versetzt. Nach längerem Rühren unter sorgfältigem Waschen wird ein vollkommen geruchloses Fett von nicht ranzigem Geschmack erzielt. Ref. hat Proben von so behandeltem Cocosöl für amerikanisches Schweineschmalz gehalten.

2. Schmiermittel.

Ueber den Vorzug der Mineralöle als Schmiermittel vor den etten Oelen werden immer mehr Stimmen laut. In einem Aufsatze, welchen Gustav und Eug. Dolfus in der industriellen Gesellschaft in Mühlhausen über Schmiermittel mitteilen, sprechen sich dieselben folgendermaassen aus: „Wir sind der Meinung, dass die reinen Mineralöle das beste Schmiermittel abgeben. Es giebt Oele dieser Gattung, genug klebrig, um eigentümliche Mischungen für alle Maschinenteile machen zu können. Die Anwendung dieser Oele zum Schmieren der Dampfkolben ist bei weitem der Anwendung der animalischen oder der vegetabilischen Oele vorzuziehen, weil das Verderben der Dampfapparate nicht so sehr zu befürchten ist. Die Mischungen der vegetabilischen mit den animalischen Oelen geben ein weniger gutes Schmiermittel, weil diese Mischungen sich beim Gebrauch verändern. Wir sind der Meinung, dass es notwendig ist, um die reinen Mineralöle zu untersuchen, festzustellen: 1. ihren Entzündungspunkt; 2. ihre Dichtigkeit; 3. ihre Klebrigkeit.. Wenn diese drei Punkte den vorstehenden Angaben über Oele, welche in der Praxis auf eine Gattung Schmieröl passen, entsprechen, so wird man ein neues Oel haben, welches, der Ursprung und der Name desselben sei welcher immer, dieselben Eigenschaften haben wird, wie das zum Vorbild genommene, nur muss vorausgesetzt werden, dass es rein mineralisch ist.“ (Maschinenb. 1882, 315; Seifenfabr. 1883, 302.)

Sehr gut sind die russischen Mineralschmieröle, besonders die „Oleonaphta“ von Ragosin & Co., mit welcher auch auf französischen Dampfschiffen als Cylinderöl sehr gute Resultate erzielt sind. (Les corps gras industr. 9, 373; Seifenfabr. 1883, 414.)

Fig. 271.



Anton Koellner in Neumühlen bei Kiel hat sich einen Apparat zur Reinigung von dickflüssigem Oel und Maschinenfett patentiren lassen. (D. P. 22124.) Der Apparat ist mit einem Dampfmantel *b* umgeben, um dickflüssige Substanzen filtriren zu können. Mit diesen wird die Kammer *a* angefüllt; sie schmelzen und lassen die Verunreinigungen auf dem Boden von *a* fallen. Die Oele etc. fliessen dann durch die Filtrirbehälter *d* und *f*, die mit Fasermaterial gefüllt sind, und sammeln sich in *g* an. Mit

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den Schrauben *h* wird das Filtermaterial entsprechend comprimirt, *k* ist eine Luftentweichungsröhre.

3. Harze und Firnisse.

Zum Raffiniren von Kampher hat sich William Henry Atkinson in London folgendes Verfahren nebst Apparat patentiren lassen. (D. P. 15916 vom 27. März 1881.) Zum Sublimiren des Kamphers dienen Gefässe von Eisen oder anderem Metall, mit abnehmbarem Deckel, bei denen die innere Fläche des Gefässes und des Deckels mit Blei ausgelegt ist. Der raffinirte Kampher wird mit der Bleieinlage herausgenommen; dass Blei wird abgestossen und wieder ausgewalzt.

Auch August Mailer in Berlin hat ein Verfahren und Apparat zum Raffiniren von Kampher (D. P. 20649 vom 8. November 1881) angegeben. Der Kampher kommt in einen Blechkasten von etwa 8 cm Höhe und 50 cm im Qnadrat. Der selbe wird mit einer Platte aus Asbest, Pappe oder einem anderen schlechten Wärmeleiter bedeckt. Diese Platte wird auf der unteren Seite mit Stanniol beklebt, welches durch Einschnitte in Felder geteilt wird. An diesen Einschnitten bekommt der sublimirte Kampher Sprünge und spaltet sich dann leicht in Tafeln von der Grösse der Felder. Durch die Platte geht in der Mitte ein Röhrchen, durch welches die Wasserdämpfe entweichen. Der Kasten hat einen breiten Rand, auf welchen die Platte gelegt wird. Darüber kommt ein eiserner Rahmen, und das Ganze wird verschraubt.

Einen Leinölersatz stellt Peter Gerion Oster in Köln folgendermaassen her. (D. P. 18767.) 5·25 T. helles Burgunderharz werden geschmolzen und mit 2·725 T. rohem Cottonöl und 0·5 T. dickem, holländischem Standöl, welche beide vorher auf 80° erhitzt sind, gemischt. Hierauf giesst man 3·5 T. ebenso heisses Petroleum hinzu und erwärmt das Ganze. Nach dem Erkalten setzt man noch 0·025 T. einer Mischung von gleichen Teilen Baldrianöl und Mirbanessenz hinzu und lässt das Gemenge sich klären. Das so bereitete Oel dient zum Ersatz des Leinöls und für die Seifenfabrikation. Kocht man das Cottonöl vor der Verwendung mit 3 Proc. Glätte, so erhält man eine Masse, welche das gekochte Leinöl bei der Farbenbereitung, Lackfabrikation etc. ersetzen soll.

Um die Klebrigkeit von Lack rasch zu beseitigen, setzt J. H. Reinhardt in Würzburg (D. P. 19220 vom 27. Januar 1882), die lackirten Gegenstände in geschlossenen Räumen der Einwirkung bewegter ozonisirter Luft aus.

Justus Wolff in Mannheim verwendet die Rückstände von der Reinigung des Baumwollensamenöls zur Darstellung von lederähnlichen und plastischen Massen. (D. P. 20483 vom 17. Februar 1882.) Der trockene pulverförmige Rückstand des Baumwollsamenöls wird mit Fetten, Oelen, Paraffin, Ceresin, Wachs, Harzen oder dergleichen, ferner mit Graphitpulver, Zinnober, Russ oder dergleichen innig vermengt, und dann wird den Gemengen Schwefelpulver oder Schwefelkohlenstoff zugesetzt. Durch Erhitzen

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dieser Massen auf 80° bis 150° C. erhält man eine mehr oder weniger harte plastische Masse.

Nath. Chapman Mitchell in Philadelphia gewinnt Gummi aus Abfällen von Gummiwaaren nach folgendem Verfahren wieder. (D. P. 18136 vom 22. November 1881.) Die Abfälle werden mit concentrirter Schwefelsäure oder Salzsäure behandelt. Das Gewebe wird zerstört und die Mineralsalze werden entfernt. Die dicke Masse wird in einer Waschmaschine gereinigt. Wenn die Abfälle grössere Klumpen bilden, so wird zweckmässig ausser den Säuren etwas Benzin zugesetzt. Die hohe Temperatur wird durch Dampf unter Druck erzeugt, wobei Vorkehrungen getroffen sind, dass der Dampf abzieht und die Schwefelsäure nicht verdünnen kann.*)

Um vulcanisirten Kautschuckstoffen ein sammtartiges Aussehen zu geben wird nach D. P. 21518 von Joseph Reithoffer's Söhne in Wien auf dem Kautschukstoff direct nach dem Auftragen der letzten mit Benzin erweichten Teigmasse eine Schicht fein pulverisirter Kartoffelstärke gestreut und durch Leisten, die mit Sammt oder Tuch gepolstert sind, über die ganze Fläche gleichmässig ausgebreitet. Der Stoff wird nun in der Weise zusammengelegt (duplirt), dass die mit Kautschuk und Stärke belegte Seite nach innen kommt, dann auf den Vulcanisircylinder gewickelt und vulcanisirt.

Ulrich Kreusler in Bonn und Emil Budde in Constantinopel ist ein Verfahren zum Paraffiniren von Kautschukwaaren patentirt worden. (D. P. 18740 vom 26. August 1881.) Die fertigen Kautschukwaaren werden, um dieselben vor dem Hart- und Rissigwerden zu schützen, je nach der Grösse einige Secunden bis zu mehreren Minuten in ein Bad von geschmolzenem Paraffin von etwa 100° C. getaucht und darauf in einem auf ca. 100° C. erwärmten Raum zum Trocknen gebracht.

M. Zingler in London stellt einen Ersatz für Guttapercha in folgender Weise her: (Engl. P. 1153 vom 9. März 1882; D. P. 20939 vom 15. April 1882.) Copal- oder ein anderes Harz wird unter Zusatz von etwas Kampher in Terpentinöl gelöst. Diese Lösung wird mit Schwefelblumen gekocht und mit Eiweis, Caseïn oder Pflanzeneiweiss, versetzt. Dann wird dieselbe mit einer Lösung, welche 30 Proc. des Harzes an Gerbsäure, Catechu oder gepulverte Galläpfel enthält, vermischt und eingekocht. Die Masse wird mit heissem Wasser durchgeknetet, gewalzt und getrocknet.

Die Compagnie Lincrusta-Walton in Paris hat sich Herstellung, Pressen und Coloriren von Füllstücken, Friesen, Verzierungen u. s. w. patentiren lassen. (D. P. 16709.) Die Masse, welche zu diesen Zwecken benutzt wird, besteht aus einer Mischung von 200 kg oxydirtem Oel, 10 kg Copal und 50 kg Harz, von welcher 24 kg mit 24 kg Holzstoff, 3 kg Bleiweis und 1 kg Pigment versetzt werden. Durch starkes Pressen und Erwärmen werden die Stücke geformt und gehärtet.

*) Vgl. auch Techn.-chem. Jahrb. 1881, S. 247; 1882, S. 309.

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4. Stearin.

Auf der Ausstellung in Paris 1878 hatte A. Fournier in Marseille Palmitinsäure ausgestellt, welches nach dem Verfahren von Saint Cyr-Radisson aus Oelsäure hergestellt war. Ueber dieses Verfahren, welches, wenn sich die dafür gemachten Rentabilitätsangaben bewahrheiten, für die Stearinindustrie von ausserordentlicher Bedeutung ist, hat W. Lant Carpenter, der dasselbe in Dänemark kennen zu lernen Gelegenheit hatte, in der Society of Chemical Industry in London nähere Mitteilungen gemacht, denen wir folgendes entnehmen:

Das Verfahren von Radisson gründet sich auf die schon 1841 von Varrentrapp entdeckte Einwirkung schmelzender Alkalien auf Oelsäure, wobei letztere in Palmitinsäure, Essigsäure und Wasserstoff zerfällt nach der Gleichung:

$$C_{18}H_{34}O_2 + 2HKO = C_{16}H_{31}KO_2 + C_2H_3KO_2 + H_2$$

Oelsäure — Palmitinsäure — Kaliumacetat

Radisson verfährt nun, wie sich Carpenter in Kopenhagen überzeugte, folgendermaassen:

Die Umwandlung wird ausgeführt in gusseisernen Kesseln von nahezu 4 m Durchmesser und 1·6 m Höhe mit schmiedeeisernen Deckeln. Nicht zu nahe darunter befindet sich die Feuerung, um ein Ueberhitzen zu vermeiden. Etwa 1·5 t Oelsäure und 2·5 t Kalilauge mit einem specifischen Gewichte von 43° B. werden in die Kessel gepumpt. Der entwickelte Dampf entweicht durch ein Mannloch im Deckel. Wenn die Seife trocken wird, schliesst man das Mannloch, und die entwickelten Gase werden in Röhren durch einen Kühlapparat nach einem Gasometer fortgeführt. Die Temperatur der Masse steigt allmälig bis 408° C. In der Masse befindet sich ein Rührwerk zur gleichmässigen Verteilung der Wärme und zur Zerstörung des Schaumes. Schliesslich schmilzt die Seife; bei 290° entwickelt sich Wasserstoff, bei 408° haben die entweichenden Gase einen besonderen, leicht zu erkennenden Geruch, und bei diesem Punkte ist es nötig, die Operation zu unterbrechen, sonst entsteht eine Destillation unter Zersetzung. Um den Process zu beendigen, wird Dampf und Wasser durch einen Giffard-Injector eingeführt und gleichzeitig ein Ablass am Boden geöffnet, durch welchen das Kaliumpalmitat in ein offenes Reservoir fliesst, woselbst die Seife mit einer zum Schmelzen genügenden Menge Wasser durch directe Dampfeinströmung erhitzt wird. Dann lässt man das Kaliumpalmitat sich über der Kalilauge von etwa 18° B. absetzen. Das neutrale Palmitat wird in einem andern Kessel mit Schwefelsäure zersetzt, die letzten Reste von Kaliumsulfat werden mit Wasser ausgewaschen. Die Palmitinsäure krystallisirt beim Abkühlen in grossen, chocoladefarbenen Tafeln. Der Erstarrungspunkt schwankt zwischen 50° und 52·7° C., je nach dem verwendeten Oele. Es kann in den üblichen Apparaten leicht destillirt werden und hinterlässt nur einen pechartigen Rückstand von 3 Proc. Nach der Destillation ist es vollkommen

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weiss. 100 Tle. Oelsäure, die von der Zersetzung des Talgs etc. mit resultiren, geben 91 Tle. Palmitinsäure; Oelsäure vom Destillationsrosse giebt nur 87 Proc. infolge eines Gehaltes an nicht umwandelbaren Kohlenwasserstoffen. Die Kosten berechnen sich in Marseille pro 100 kg weisser Palmitinsäure aus destillirter Oelsäure und durch Behandlung mit Kalilauge folgendermaassen:

Allgemeine Unkosten	5·80 Frcs.
Arbeitslohn	6·35 „
Verlust an Alkali	2·60 „
Kohlen	8·10 „
Kalkcarbonat	0·60 „
Gebrannter Kalk	0·65 „
Schwefelsäure	2·60 „
Abfälle beim Betriebe	0·95 „
Destillation	3·50 „
	31·15 Frcs.

oder etwa 13 £ pro 1 t. Es kann nach Radissons neueren Versuchen auch vorteilhaft Natronlauge anstatt Kalilauge verwendet werden, dann verringern sich die Kosten auf 7·10 £ anstatt 13 £ pro 1 t. (Ist nach obiger Rechnung nicht recht verständlich. Ref.)

Die Ersetzung des Kalis durch Natron bei diesem Process bot anfangs grosse Schwierigkeiten, weil das ölsaure Natron verhältnismässig schwer schmelzbar und ein schlechter Wärmeleiter ist, so dass eine gleichmässige Temperatur des geschmolzenen Salzes auch bei Anwendung eines Rührwerks nicht zu erzielen war. Radisson hat jedoch gefunden, dass dieser Uebelstand beseitigt wird, wenn man dem Gemisch von Natronlauge und Oelsäure eine gewisse Menge Paraffin zusetzt. Das Paraffin bewirkt eine vollständige Verflüssigung der Masse und verhindert eine Erhitzung des Natriumpalmitats über seine Zersetzungstemperatur, da sein Siedepunkt niedriger, als diese liegt. Die kleine Menge von Paraffin, welche sich während der Operation verflüchtigt, wird in einem Condensator aufgefangen. Der entweichende Wasserstoff ist so reich an Kohlenwasserstoffen, dass er ein gutes Leuchtgas bildet. Nach Beendigung der Reaction wird die Masse, wie gewöhnlich, mit Wasser behandelt und trennt sich dann in drei Schichten, von denen die oberste Paraffin, die mittlere Natriumpalmitat und die untere Natronlauge ist, mit einem Gehalt an Natriumacetat. Das Paraffin und die Natronlauge werden für die folgenden Operationen benutzt, das Natriumpalmitat wird durch Schwefelsäure zersetzt. (Journ. soc. chem. ind. 1883, pag. 98; Chem. Ind. 1883, S. 170.)

A. Motard & Co. in Berlin ist die in Fig. 272 abgebildete Maschine zum Konischfraisen der Enden von Kerzen aus Stearin oder anderem Material patentirt worden. (D. P. 19656 vom 10. Januar 1882.) Eine zur Aufnahme der Lichte dienende, mit Cannelirungen versehene Platte *A* ist um eine Achse *a* drehbar. Die Lichte werden, wenn sich die Platte in

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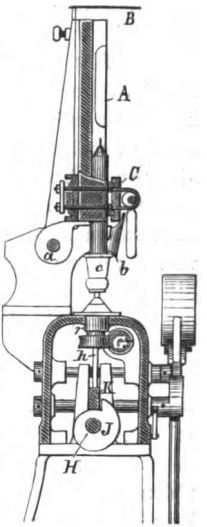
geneigten Lage befindet, in die Cannelirungen verteilt, wobei sie durch Stossblech *B*, welches je nach der Länge der Kerzen einzustellen ist, am Herabgleiten nach hinten verhindert werden. Bringt man die Platte *A* nun in die verticale Stellung, so rutschen die Lichte nach unten und werden durch das Schuttzblech *b* einerseits am Herausfallen gehindert, andererseits gezwungen, in die konischen Fräser *c* zu gleiten. Durch Gegendrücken von Brett *C* gegen Platte *A* werden die Kerzen festgehalten. Die Fräser *c*, aus konischen Hülsen bestehend, deren innere Wandung mit mehreren Messern versehen ist, sind auf vierkantigen Stahlstangen *h* befestigt, welche in den mit Schraubenrädern aus einem Stück gefertigten Büchsen *r* lose auf- und niedergleiten können. Nun wird die Schraube *G* in Bewegung gesetzt und überträgt diese auf die Fräser *c*. Gleichzeitig dreht sich die Welle *H*, und die auf derselben befestigten Hebedaumen *J* bewegen die Leiste *K*, welche den vierkantigen Fräserachsen *h* als Stützlager dient, aufwärts und bewirken ein allmäliges konisches Anschneiden der Lichtenden. Nach einmaliger Umdrehung der Welle *H* fällt, sobald der höchste Anhub durch die Daumen erfolgt ist, die Leiste *K* herab, so dass die Fräser sich wieder senken und ihre Anfangsstellung einnehmen können. Hierauf erfolgt eine selbstthätige Arretirung der Maschine.

Fig. 272.



5. Seife und Glycerin.

Die ungünstige wirtschaftliche Lage der Seifenindustrie, auf welche wir bereits im vorjährigen Bericht hingewiesen haben, hat sich nicht gebessert. Die Preise der Seifen sind, trotz vielfacher Bemühungen von Einzelnen und von Verbänden eine Aufbesserung herbeizuführen, nicht höher gegangen, während die Rohmaterialien, namentlich die Fette und Oele, vielfach teurer geworden sind. Die grossen Mengen Talg, welche heute von der Margarinindustrie consumirt werden, haben die Preise dieses wichtigen Fettes so in die Höhe getrieben, dass dieselben von der Seifenfabrikation kaum noch getragen werden können. Zur Verteuerung des Talges hat auch der jetzige deutsche Zolltarif beigetragen. Der gegen Ende des Jahres 1879 in Kraft getretene Zolltarif hob die bis dahin bestandene Zollfreiheit aller zur Seifenfabrikation notwendigen Rohproducte und belegte die dafür wichtigsten Fette, Palmöl, Palmkernöl, Cocosöl, Talg, Knochenfett und Tierfette, nicht besonders benannter Art, mit einer Steuer von 2 ℳ pro 100 kg brutto. Um diesen niedrigen Steuersatz nur den Fetten zu technischen Zwecken zu gute kommen zu lassen und zu verhindern, dass Fette, welche zu Speisezwecken dienen sollen, als zu technischen Zwecken bestimmte ein-

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geführt würden, erliess der Bundesrat dazu die Bestimmung, dass Fette, welche bei einer Temperatur von 14 bis 15° R. eine schmalzartige Beschaffenheit zeigen, dem Zollsatz von Margarin, Palmitin und Stearin von 8 ℳ pro 100 kg unterliegen. Diese Bestimmung brachte eine grosse Unsicherheit in das Geschäft, indem zahllose Fälle vorgekommen sind, wo dasselbe Fett von einzelnen Hauptzollämtern mit 2 ℳ, von anderen dagegen mit 8 ℳ versteuert wurde. Dies veranlasste den Verband der Seifenfabrikanten zu Anfang dieses Jahres an den Bundesrat eine Petition zu richten: „Talg sowie Fette nicht besonders benannter Art, auch wenn sie von Schweinen oder anderen Tieren herstammen, mit dem gesetzlichen Zollsatz von 2 ℳ pro 100 kg in Deutschland einführen zu lassen“ (vgl. Seifenfabrikant, 1883, 61). Dieser Petition ist vom Bundesrat entsprochen worden, aber unter der Bedingung, dass die betreffenden Fette zuvor denaturirt werden. Als Denaturirungsmittel sind bestimmt 2 Proc. Paraffinöl oder Petroleum. Der Geruch dieses Mineralöls haftet aber so fest an den Fetten, dass die daraus dargestellten Seifen ihn noch ganz intensiv zeigen und fast unverkäuflich sind, ein Umstand, der die Begünstigung, welche der Bundesrat der Seifenindustrie hat gewähren wollen, vollständig illusorisch macht.

Ausser dem Talg ist besonders das Palmöl, welches ja ersteres zu vielen technischen Zwecken vertritt, bedeutend im Preise gestiegen, und so ist es gekommen, dass diese beiden so wichtigen Fette aus vielen deutschen Siedereien jetzt ganz oder wenigstens fast ganz verschwunden sind. An Stelle derselben sind vielfach billigere Fette, namentlich Walkfett und Knochenfett getreten. Ueber ersteres wird von den Seifensiedern vielfach geklagt, dass es erheblich schlechter geworden sei und häufig auch unverseifbare Kohlenwasserstoffe enthalte. Die schlechtere Beschaffenheit wird darauf zurückgeführt, dass die Seifen durchschnittlich und so auch die von den Tuchfabrikanten benutzten jetzt aus geringeren Fetten hergestellt sind, so dass man aus den Seifenwässern auch nur geringere Fette wiedergewinnen kann, der Gehalt an Kohlenwasserstoffen dagegen auf den Umstand, dass von den Fabriken zu vielen Zwecken heute Mineralöle zur Verwendung gelangen, zu denen früher fette Oele verwandt wurden. (Vergl. Seifenfabr., 1883, 349.)

Man hat bekanntlich harte Seifen und Schmierseifen. Von ersterer unterscheidet man dann gewöhnlich zwei Arten: Kernseifen und Leimseifen; hierzu kommt aber noch eine dritte, eine Halbkernseife, die gewöhnlich als Eschweger bezeichnet wird. Diese lestere ist von allen harten Seifen die wichtigste Seife der deutschen Fabriken, zugleich aber auch diejenige, welche im Preise am gedrücktesten ist, trotzdem ihre Herstellung mit manchen Schwierigkeiten verknüpft ist und ein Misslingen recht häufig vorkommt. Die Kernseifen werden hergestellt, indem man das fettsaure Alkali durch Aussalzen von dem überschüssigen Wassergehalt und dem Glycerin befreit; sie zeigen eigentümliche Krystallisationsbildungen, die man als Kern und Fluss bezeichnet. Die Leimseifen, welche nur mit Hilfe von Palm-

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kernöl oder Cocosöl darstellbar sind, enthalten alles in den zur Verseifung gelangten Fetten vorhandene Glycerin, haben ziemlich hohen Wassergehalt und zeigen keine Kern- und Flussbildung. Die Eschweger Seife kann auch nur mit Hilfe von Cocosöl oder Palmkernöl hergestellt werden; aber sie zeigt in etwas Kern- und Flussbildung, die man durch Zugeben färbender Substanzen — Frankfurter Schwarz, Ultramarin, Englisch Rot — stärker hervortreten lässt.

Zum Sieden der Eschweger Seife kann man zwei Wege einschlagen: einen directen und einen indirecten. Bei dem ersten Verfahren werden Cocosöl oder Palmkernöl mit andern Fetten — Talg, Palmöl, Knochenfett, Walkfett — gemeinschaftlich versotten; bei dem zweiten dagegen wird erst aus einem oder mehreren der zuletzt genannten Fette eine Kernseife hergestellt und diese dann einer aus Cocosöl oder Palmkernöl gesottenen Leimseife zugegeben. Die Eschweger Seife hat zu ihrer richtigen Ausbildung einen bestimmten Gehalt an Salzen nötig. Als solche Salze dienen meist die kohlensauren Alkalien; doch lassen sich dieselben auch durch manche andere Salze, z. B. Wasserglas und Chlorkalium, ersetzen, und beruht auf dieser Erscheinung die Anwendung der letzteren als Füllungsmittel für die genannte Seife. Eine Eschweger Seife, welche nicht genug Salze enthält, welche, wie der Seifensieder sich ausdrückt, nicht genügend „gekürzt" ist, zeigt den Uebelstand, dass sie beschlägt, indem Salze auswittern. Diese eigentümliche Erscheinung sucht Wilh. Rödiger (Seifenfabr., 1882, 454) in folgender Weise zu erklären: „Bingel (Seifenfabr., 1881, 82) lässt durch die Zwischenlagerung der einzelnen Salzatome zwischen die Seifenatome die sonst zähe Beschaffenheit der Seife aufheben, je mehr Salze bis zu der gegebenen Grenze, je weniger zäh, je flüssiger die Seife, je grösser die Möglichkeit der Bewegung der den Marmor bildenden fremden Bestandteile bei der Eschweger Seife. Vergegenwärtigen wir uns nun den Vorgang, wenn Eschweger Seife der Luft ausgesetzt wird. Es findet ein sehr ernergischer Trockenverlust statt, welchen man am besten ersieht, wenn am Ende des Jahres die verkaufte Waare mit dem verseiften Fett in Parallele gestellt wird. Alle die Fabrikanten, welche sich eine Ausbeute von 220 Pfd. und mehr calculiren, würden ein sehr verdutztes Gesicht machen, wenn sie sich einmal der Mühe unterziehen wollten, nicht nach Calculationssuden, sondern am Ende des Jahres unter Berücksichtigung der Inventurbestände nach dem verkauften Product zu rechnen. Der Wasserverlust findet nun aber ganz naturgemäss an der Oberfläche der Seife statt, und die wieder naturgemässe Folge hiervon ist ein ganz bedeutendes concentrirter Werden der Salzlösungen in den äusseren Schichten der Seife. Haben wir nunmehr eine Seife, welche genügend gekürzt ist, in welcher eine Bewegung der Bestandteile möglich ist — dass eine solche Bewegung auch in erstarrten Seifen überhaupt möglich ist, sehen wir sowohl an der Auswitterung der Eschweger Seifen, als in der Kornbildung der Schmierseifen, — so wird fortschreitend mit der Concentration der äusseren Schichten ein Austausch mit den inneren schwächeren Salzlösungen stattfinden. Es findet eine

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Diffusion statt. Die concentrirter werdenden Lösungen wandern nach innen, die schwächeren inneren Lösungen wandern nach aussen, und dieser Vorgang dauert so lange, bis die allmälig immer härter werdende Seife das Wandern der Salzlösungen unmöglich macht, aber nicht nur nach innen, sondern auch nach aussen, so dass auf diese Weise es auch erklärlich ist, weshalb Eschweger Seifen, welche überhaupt nicht zum Ausschlagen neigen, auch nach durch allmäliges Trocknen herbeigeführtem Verluste ihres gesamten überhaupt abgehbaren Wassers, keinen Ausschlag zeigen. Die Salzlösungen vertrocknen in feiner Verteilung in der Seife allmälig ohne Hinterlassung sichtbarer Krystalle. Haben wir dagegen eine Seife, welche nicht genügend gekürzt ist, welche nicht durch zwischengelagerte Salze ihre Zähigkeit verloren oder doch nicht in genügendem Maasse verloren hat, so wird die Sachlage eine andere. Der Trockenverlust der äusseren Schichten findet in derselben Weise statt, die Lösung der Salze wird in den äusseren Schichten concentrirter, das Bestreben zur Diffusion tritt ein, aber die Bewegungsfähigkeit ist, wenn nicht ganz, so doch teilweise unterbunden; ähnlich wie in einer zu harten oder zu zähen Elaïnseife das Korn entweder gar nicht oder erst nach langer Zeit herauskrystallisiren kann, ähnlich wird in diesem Falle die Bewegungsfähigkeit der sich austauschen wollenden verschieden concentrirten Salzlösungen verhindert oder doch so verzögert, dass die Concentration der in den äusseren Schichten befindlichen Lösungen sehr schnell eine grössere geworden ist, als für die Löslichbleibung der Salze möglich ist. Das kohlensaure Natron, als zuerst am Krystallisationspunkt anlangend, tritt aus der Lösung aus, naturgemäss da, wo eben die Lösung am concentrirtesten ist, an der Oberfläche der Seife, ähnlich, wie sich bei verdunstenden Salzlösungen bei Eintritt des Sättigungspunktes zunächst oben auf der Oberfläche das bekannte Salzhäutchen zeigt, welches wohl schon jeder Seifensieder beim Lösen von chromsaurem Kali beim Mangel von Wasser beobachtet hat."

Ueber „fehlgeschlagene Eschweger Seifen" schreibt Fr. Stein im Seifenfabrikant (1883, 63, 74 und 97). Er empfiehlt, solche Seifen auszusalzen.

Die alten Kernseifen, welche einfach durch Aussalzen des Seifenleims erzeugt wurden, sind heute vielfach verdrängt durch die sogenannten abgesetzten Kernseifen. Diese Seifen werden ebenfalls mit Hilfe von Cocosöl oder Palmkernöl hergestellt. Das Sieden geschieht ganz ähnlich wie bei der Eschweger Seife und zwar auch entweder auf directem oder indirectem Wege; nur erfolgt schliesslich ein Aussalzen entweder durch Salz oder einen Ueberschuss von Lauge. Die Seife darf sich dabei aber nicht vollständig aussalzen, sondern muss noch im Leim bleiben. Nach Beseitigung des Feuers wird dann der Kessel gut zugedeckt und so längere Zeit der Ruhe überlassen. Es setzt sich dann unten ein wässeriger Seifenleim ab, während sich darüber eine reine Kernseife befindet. Wurden zu der Seife weisse Fette verarbeitet, so ist diese Kernseife von reiner Weisse und zeigt Silberglanz. — Ueber abgesetzte Seifen schreibt L. Borchert im Seifenfabrikant (1883, 38). — Die unten im Kessel

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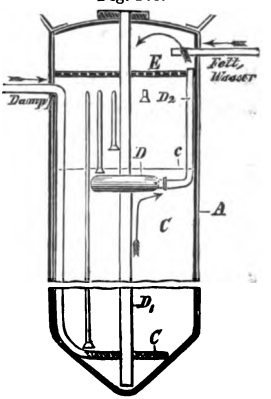
befindliche Leimseife wird ausgesalzen. Ueber Verwendung dieses sogenannten „Leimkerns“ ist im Seifenfabrikant (1882, 227) geschrieben.

Unter den Harzseifen ist jetzt eine transparente Harzkernseife sehr beliebt; ihre Darstellung ist beschrieben im Seifenfabrikant (1882, 490).

Henry Heckel in Cincinnati, Ohio, V. S. A. sind Neuerungen in dem Verfahren und den Apparaten zur Verseifung von Fetten und Oelen patentirt worden. (D. P. 21187 vom 28. März 1882.) Bei der Darstellung von Seife aus Fetten wird das Glycerin zunächst aus den neutralen Fetten dadurch abgeschieden, dass man die letzteren der directen Einwirkung von Dampf und Wasser unter einem Drucke von ungefähr 10 Atmosphären aussetzt (wobei chemische Agentien nicht erforderlich werden), und dann den verbleibenden Rückstand auf bekannte Weise verseift. Zur Verseifung wird das Fett mit Wasser innigst gemischt, dürch die directe Einwirkung von Dampf unter einem Druck von ungefähr 10 Atmosphären erhitzt und durch ein begrenztes Dampfvolumen unter Druck durchsickern gelassen. Der hierfür benutzte Apparat (Fig. 273) enthält im Dampfraum über der Fett- und Wassermischung *C* eine gelochte Scheidewand *E*, durch welche der emporgepumpte Teil der Fettemulsion durchsickert. Die Bewegung der Emulsion bewirkt eine rotirende Pumpe *D*, welche unter dem Flüssigkeitsniveau *c* liegt und mit dem Saugrohr D^1 und dem Ausflussrohr D^2 versehen ist, um die Flüssigkeit aus dem unteren Teil des Behälters *A* über die Scheidewand *E* zu pumpen und sie durch die letztere hindurchsickern zu lassen. Mittelst des perforirten Dampfrohres *C* im unteren Teil des Behälters *A* wird Dampf in Stralen in die Masse geblasen, um dieselbe während der Dauer des Processes (circa 7 Stunden) auf 180° C. zu erhalten.

Fig. 273.



Oscar Liebreich in Berlin hat sich die Anwendung von kaltverseifbare Fette enthaltenden Früchten in stark zerkleinertem Zustande zur Seifenbereitung patentiren lassen. (D. P. 21585 vom 12 April 1882.) Dieses Verfahren bezweckt eine Gewinnung von Seife aus Oelfrüchten, besonders der Palmfrucht, ohne vorheriges Pressen. Die Palmfrucht wird in Stücken bei 120° geröstet und dann gemahlen bis sie breiartig wird. Der Brei wird mit concentrirter Natron- oder Kalilauge versetzt und unter Ersetzung des verdampfenden Wassers mehrere Stunden auf 100° erhitzt. Nach beendeter Verseifung setzt man mehr Wasser hinzu und coulirt die Lösung. Der Rückstand wird wiederholt ausgelaugt und dann abgepresst. Die Lösung wird abgedampft, wodurch man eine schwarze Rohseife erhält, oder sie wird in geeigneter Concentration ausgesalzen, wobei sich eine Kernseife abscheidet, die dann geschliffen wird.

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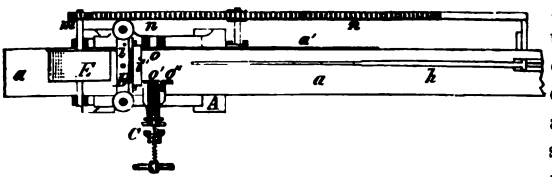
Adolf Krull in Helmstedt hat sich eine Maschine zum gleichzeitigen Hobeln, Egalisiren und Teilen von Seife und ähnlichen Stoffen patentiren lassen. (D. P. 18729.)

Fig. 274.



Zwei Hobelmesser o und o' dienen dazu, die verticalen Seiten des von der Stange h auf Tisch a vorzuschiebenden Seifenriegels zu hobeln. Kurz hinter o sind zwei unterhalb des Supportes D liegende Hobelmesser i angeordnet, welche die obere und untere Seite des Riegels hobeln.

Vor dem Hobelmesser o^1 und gegenüber der festen Wand a^1 befindet sich ein eisernes, messerähnliches Instrument o'', welches vorn eine stumpfe Kante hat und mit derselben grössere Unregelmässigkeiten des Riegels abschabt, so dass das dahinter liegende Hobelmesser nur einen dünnen Span fortzunehmen hat. o' und o'' sind zusammen zu einem verstellbaren Support c befestigt. In analoger Weise ist vor dem oberen Messer i der Vorschneider i'' an dem verstellbaren Support D befestigt. Die rotirende cylindrische Walze E dient zum Stempeln der Seife; sie trägt eine entsprechende Gravirung und wird von der zugleich mit Stange h vorangehenden Zahnstange n und dem Rad m gedreht.

Pierre Py in Meurad, Algier, ist die Herstellung von künstlichen Steinen aus Rückständen von der Kaustificirung der Seifensiederlauge patentirt worden. Die Rückstände werden unter hydraulischem Druck zu Bausteinen gepresst, wobei für die Seifenfabrikation benutzbare Aetzlauge abläuft. Die Steine lässt man zur Erhärtung einige Tage an der Luft liegen. Steine zum Pflastern der Fussböden von Räumen erhält man, indem man die Rückstände mit etwas Cement anmacht und presst.

Für Gewinnung von Glycerin aus Unterlaugen sind wieder mehrere Patente erteilt, ohne dass damit die Frage ihrer Lösung näher gerückt wäre.

Von J. P. Battershall in New-York (Engl. P. 1728 vom 12. April 1882) wird zunächst das Alkali in den Laugen mit Schwefelsäure neutralisirt. Dann wird in geeigneten Kesseln bis auf $^1/_{10}$ eingedampft. Wenn Fett oder Harz vorhanden ist, wird dies durch Coliren abgeschieden. Dann wird kohlensaurer Kalk zugesetzt und weiter eingedampft, bis die aus den Chloriden und Sulfaten der Alkalien, aus Calciumsulfat und -carbonat und Glycerin bestehende Masse beim Erkalten eine dickliche Consistenz annimmt. Von dieser wird in einer Centrifuge der grösste Teil der Salze ausgeschieden. Das gewonnene Glycerin, welches noch Salze aufgelöst enthält, wird dann mit Wasserdampf abdestillirt. Oder aus der abcentrifugirten Glycerinlösung werden die Salze zunächst durch Alkohol gefällt, dann folgt die Destillation.

Von Ch. Thomas in Bristol und Alb. Domeyer in London (Engl. P. 2462

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vom 4. Juni 1881) wird die Seifenlauge soweit concentrirt, bis sich Kochsalz auszuscheiden beginnt. Der Flüssigkeit wird 1 bis $1^1/_2$ Proc. Säure zugesetzt, wodurch sich noch vorhandene Seifensubstanz zersetzt, harzige Stoffe ausgeschieden und andere Stoffe gefällt werden. Die sich an der Oberfläche sammelnden fetten Säuren und Harze werden abgeschöpft. Die darauf filtrirte Flüssigkeit wird weiter eingedampft. Das erhaltene Rohglycerin wird mit einem Teerkohlenwasserstoff, Petroleum, Schwefelkohlenstoff oder Amylalkohol gewaschen, welche Stoffe die Verunreinigungen lösen. Was von diesen Mitteln zurückbleibt, wird durch Behandlung des Glycerins mit heisser Luft entfernt. Der zur Concentration der Laugen benutzte Apparat besteht aus einem Cylinder mit geneigten Flächen im Innern, über welche die Laugen herunterrieseln und dabei einem Strom heisser Luft begegnen.

Von Francis Joseph O'Farrell in Dublin (D. P. 20275 vom 20. Januar 1882) wird die Unterlauge eingedampft und dann von neuem zum Aussalzen benutzt. Dies wird verschiedene Male wiederholt. Man dampft dann die Unterlauge so weit ein, bis das Kochsalz grösstenteils auskrystallisirt. Die Mutterlauge wird nun fractionirt destillirt, und zwar unter Luftverdünnen und Einleiten von auf 200° C. erhitztem Wasserdampf, wobei zunächst Wasser, dann aber fast wasserfreies Glycerin übergeht.

Ein Verfahren, das ebenfalls die Anreicherung der Unterlauge mit Glycerin bezweckt, haben sich auch Dalton & Co. in Frankfurt a. M. patentiren lassen. (D. P. 18214 vom 19. Juli 1881.) Das Fett wird mit sehr concentrirter Natronlauge (von 38° B.) verseift. Die eingedampfte Unterlauge wird noch einmal zur Verseifung benutzt und auf diese Weise an Glycerin angereichert. Zum Aussalzen ist nur eine sehr geringe Menge Kochsalz oder Alkalisulfat erforderlich.

Von der Société E. Brochon & Co. in Mailand (D. P. 21586 vom 13. Juni 1882) werden die Seifenwässer mit Kochsalz versetzt. Die filtrirte Flüssigkeit wird mit Salzsäure oder Schwefelsäure angesäuert, wobei sich fette Säuren abscheiden, die aus der Flüssigkeit durch ein Klärungsmittel niedergeschlagen werden. Als solches verwendet man Albumin oder dergleichen, das durch ein Metallsalz zum Gerinnen gebracht wird. Der Ueberschuss des Metallsalzes wird dadurch gefällt, dass man der heissen Flüssigkeit Kalkmilch hinzusetzt; einen geringen Ueberschuss von Kalk scheidet man durch eine abgemessene Menge von doppeltkohlensaurem Natron ab und neutralisirt mit Salzsäure. Nun wird die Flüssigkeit eingedampft. Man benutzt ein System von Pfannen in der Art, dass die Lauge dieselben der Reihe nach durchfliesst, während das auskrystallisirende Salz im entgegengesetzten Sinne von einer Pfanne in die andere gedrückt wird. Es ist dann in der ersten Pfanne eine zwar an Kochsalz gesättigte, doch in Bezug auf Glycerin sehr verdünnte Lauge vorhanden, so dass das hier herausgezogene Salz direct verwendet werden kann. Die Lauge aus der letzten Pfanne wird auf Glycerin verarbeitet.

H. Flemming in Kalk bei Cöln hat sich die Anwendung von Guttaperchapapier statt Pergamentpapier als trennende Membran bei der Osmosirung

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glycerinhaltiger Flüssigkeiten patentiren lassen. (D. P. 17547 vom 17. April 1881.) Da das Glycerin in nicht unerheblichen Mengen mit den Salzen durch Pergamentpapier diffundirt, so müssen die Osmosewässer wiederholt nach Eindampfen bis zur starken Abscheidung der Salze osmosirt werden. Diese Uebelstände beseitigt man durch Anwendung von Guttaperchapapier, welches für Glycerin undurchdringlich ist, während es die Salze hindurchlässt; doch geht der Osmoseprocess langsamer von statten. Guttaperchapapier ist auch für die Osmose anderer Flüssigkeiten als Glycerinlaugen anwendbar.

Von F. Armandy in St. Johns bei Venissieux, Rhône (Engl. P. 5348 vom 7. December 1881) wird ein Vacuumapparat beschrieben, welcher angeblich gestattet, das Glycerin in möglichst kurzer Zeit und bei möglichst niedriger Temperatur zu destilliren, so dass keine Zersetzung desselben eintreten kann.

George Payne in Millwall (Engl. P. 203 v. 14. Jan. 1882) lässt bei der Destillation von Glycerin, um die übermässige Verdünnung des überdestillirenden Glycerins zu vermeiden, das Dampfgemisch aus dem Destillationsgefäss zunächst in einem cylindrischen Raum gehen, dessen Temperatur die Condensation des Glycerins, aber nicht die des Wasserdampfes gestattet. Die Dämpfe gelangen in mehrere Röhren, die sich in dem von überhitztem Wasserdampf durchströmten Cylinder befinden.

Statistik.

Im Deutschen Reich betrug in metr. Centnern ausgedrückt, die

Waarengattung	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an Kautschuk und Guttapercha, roh oder gereinigt	19 985	19 812	1 495	1 294
„ Kautschukwaaren	1 736	1 718	19 971	19 625
„ Geweben mit Kautschuk überzogen und dergl. aus Kautschukfäden	895	919	2 419	2 625
an Olivenöl (Baumöl) in Fässern	102 315	140 529	4 477	4 364
„ Leinöl in Fässern	359 566	447 948	1 572	1 600
„ Rüböl, Rapsöl in Fässern .	3 602	4 380	88 775	60 007
„ Palmöl*), festem	89 469	79 812	85 819	80 065
„ Cocosnussöl, festem	18 306	20 835	7 905	6 520
„ Schmalz von Schweinen und Gänsen	258 703	243 543	270	295
„ Fischspeck und Fischthran	98 403	102 595	3 146	3 801
„ Talg (eingeschmolzenem Fett von Rind- und Schafvieh) .	69 937	80 930	8 253	7 214

*) Unter Palmöl ist unzweifelhaft sowol Palmöl wie Palmkernöl zu verstehen und dürfte die Einfuhr aus ersterem, die Ausfuhr aus letzterem bestehen. Ref.

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Im Deutschen Reich betrug, in metr. Centnern ausgedrückt, die

Waarengattung.	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an Teer	286 820	318 165	116 936	118 441
„ Pech	30 000	33 544	189 947	216 614
„ Asphalt (Bergteer)	151 117	176 524	137 976	94 675
„ Terpentinharz (Kolophonium, Fichtenharz) Terpentin	505 149	499 337	54 902	44 844
„ anderen Harzen	18 008	16 346	1 477	1 751
„ Terpentinöl und anderem Harzöl	79 003	81 863	14 723	12 720

C. Deite.

XXVII. Wasser.

1. Meteorwasser.

Ueber die Ursachen, welche den Ammoniakgehalt der Regenwässer beeinflussen, hat A. Houzeau (Compt. rend. **96**, 259; Chem. Centrbl. (3) **14**, 168) Untersuchungen angestellt. Regenwasser aus Algier, das Verf. untersuchte, enthielt keine Spur Ammoniak, während er früher im Nilwasser, welches in der Zeit der Ueberschwemmung gesammelt war, 0·07—1·2 mg im l fand. Es ist ein Irrtum anzunehmen, dass die meteorischen Wässer niemals Ammoniak enthalten, da es nach einer früheren Untersuchung des Verfassers sich gezeigt hatte, mit welcher Schnelligkeit die Wasser das Ammoniak unter dem Einflusse des Sonnenlichtes verlieren. Die Wärme wirkt wie das Sonnenlicht. Im Juli waren zu Rouen gesammelte Regenwässer frei von Ammoniak. Nach Houzeau liegt dies weniger an einer Verflüchtigung, als an einer Absorption durch die in den Wässern enthaltenen organischen Substanzen. Auch die Regenmenge übt einen Einfluss aus; je geringer dieselbe ist, desto reicher an Ammoniak ist das Regenwasser.

Boussingault hat Untersuchungen über das Vorhandensein der Salpetersäure und des Ammoniaks in dem Wasser und dem Schnee, welche Civiale in den Alpengletschern gesammelt hat, ausgeführt. (Compt. rend. **95**, 1121; Ber. d. chem. Ges. **16**, 87.)

Im Liter fand er:	Salpetersäure	Ammoniak
Spitze des St. Bernhard im Regenwasser.	0·30 mg	1·10 mg
„ „ „ im Schneewasser	0·05 „	Spuren
Im Wasser aus dem See in der Nähe des Hospizes von St. Bernhard	0·00 „	0·11 mg u. s. w.

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A. Müntz und Aubin (Compt. rend. **95**, 919; Ber. d. chem. Ges. **15**, 3081) haben in den meteorischen Wässern auf dem Pic du Midi (3000 m) von 13 Fällen nur zwei Mal geringe Spuren Salpetersäure (in 10 l weniger als 0·1 mg) gefunden.

Studien über die Stickstoffverbindungen in Meteorwässern hat J. Stoklasa veröffentlicht. (Listy chem. Beilage **6**, 3, 12, 29, 43.)

2. Tellurische Wässer.

Aillaud teilt Analysen der Wässer des Isthmus von Panama mit. (Compt. rend. **95**, 104.)

Ueber die chemische Zusammensetzung des Wassers der Donau vor Wien im Jahre 1878 hat J. F. Wolfbauer (Monatsh. f. Chem. **4**, 417) berichtet. Mit dem Steigen wird das Wasser trüber und weicher, mit dem Fallen klarer und härter.

H. Vogel (Rep. anal. Chem. **8**, 10) untersuchte das Wasser des bayrischen Flüsschens Iller und einiger Nebenflüsse desselben. Die Quellflüsse Stillach, Trettach, Breitach, Ostrach führen ein Wasser mit 0·1400—0·3168 g Rückstand im Liter. Das Illerwasser selbst ergab einen Rückstand, der zwischen 0·2460 (bei Blaichach) und 0·1921 g im Liter (bei Grönenbach) lag. Die stärkste Härte fand Vogel im Illerwasser bei Blaichach, nämlich 19·5° (franz.), die geringste in dem bei Immenstadt 18·0° (franz.).

Eine Untersuchung der Wässer einiger Flüsse und Quellen aus dem Centralgebiete der französischen Pyrenäen stellte H. Byasson (Journ. pharm. Chim. (5) **7**, 54; Chem. Centrbl. (3) **14**, 194) an. Die Schwefelwässer derselben Gegend unterscheiden sich nicht allein durch ihre Temperatur und ihren Schwefelgehalt, sondern auch durch den höheren Reichtum und die Natur der darin enthaltenen Salze, welche hauptsächlich alkalische Sulfate, Chloride und Silicate sind.

A. Potilitzin (J. d. russ. phys. chem. Ges. 1882 (1) 300. u. 1883 (1) 179; Ber. d. chem. Ges. **15**, 3099 u. **16**, 1395) veröffentlicht über die die Naphta begleitenden und aus Schlammvulkanen ausströmenden Wässe mehrere Arbeiten. Die im Kaukasus aus Bohrlöchern und Brunnen gewonnene und von selbst ausströmende Naphta ist fast immer von einer mehr oder weniger reichlichen Menge von Wasser begleitet, die an manchen Stellen sogar 50—90 Proc. der ausgepumpten Naphta erreicht. Die Analysen von vier Proben solchen Wassers, von denen zwei gerade entgegengesetzten Stellen des Naphtadistriktes entnommen waren und z. B. einer Bohröffnung bei Kudako auf der Halbinsel Tamen (I) und dem Schlammvulkan Daschkezan unweit der Halbinsel Aljata am westlichen Ufer des kaspischen Meeres II, die anderen Proben III aus dem Schlammvulkan Nabambrebis und IV aus der Erdölquelle „Blaschebi“ beide im Gouvernement Tiflis stammten, ergaben folgende Resultate:

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	I	II	III	IV	
	Procent				
Natriumchlorid	1·212	2·026	3·327	3·789	
Natriumbromid	0·012	0·0087	—	—	
Natriumjodid	0·0098	0·0118	—	—	
Natriumcarbonat	0·486	0·079	0·0798	0·014	
Calciumcarbonat	0·004	0·027	—	—	
Magnesiumcarbonat . . .	0·0996	0·069	0·2337	0·0058	
Kieselsäure	0·016	—	0·0077	0·0020	
Fester Rückstand, direct bestimmt	1·953	2·150	4·032 3·793	4·285 bei 100° 4·098 bei 120° getrocknet	
Calciumchlorid	—	—	—	0·1046	
Magnesiumchlorid	—	—	—	0·062	
Magnesiumbromid	—	—	—	0·0105	
Magnesiumjodid	—	—	—	0·0341	

Im festen Rückstande sind auch die Salze von organischen Säuren mit einbegriffen, die allem Anscheine nach ausschliesslich Fettsäuren sind. Die Wässer zeichnen sich durch das Fehlen von Sulfaten aus. Ein besonderes Interesse erwecken sie durch ihren reichen Jodgehalt.

Im Anschluss an diese Untersuchung beschreibt Verfasser in einer neueren Publication die Untersuchung eines Erdölwassers, das im Juli 1880 den in der Ebene von Eldar am rechten Ufer des Flusses Jordo gelegenen Fundorten entnommen worden war. (Ibid., 1883 (1) 388 d. Ber. chem. Ges. 16, 2320). Dasselbe befand sich daselbst in einer Vertiefung eines Sandsteinlagers unter einer Schicht dichten Erdöls und war mit Kohlensäure und Schwefelwasserstoff vollkommen gesättigt. Das Wasser war klar, schwach alkalisch, hatte das spec. Gew. 1·0240 bis 20°. Es enthielt:

Rückstand	2·7306 Proc.	Magnesiumcarbonat . .	0·070 Proc.
Natriumcarbonat .	0·2685 „	Calcium „ . .	0·050 „
„ chlorid . .	0·3691 „	Kieselerde	0·0016 „
„ bromid . .	0·0100 „	Schwefelwasserstoff . .	0·0016 „
„ jodid . . .	0·00214 „		

Diese sulfatfreien Wässer sind in zwei Gruppen zu teilen. 1. Die sauren Erdölwässer, die ausschliesslich Chloride (Na, Ca, Mg) enthalten und in dem östlichen Teile des Oelbezirks vorkommen; 2. Die alkalischen Erdölwässer, die ausser den genannten Chloriden noch Bromide, Jodide und fettsaure Salze enthalten und im nordwestlichen und südlichen Teile des Erdölbezirks sich finden. Der Unterschied in der Zusammensetzung dieser beiden Gruppen von Wässern steht jedenfalls mit der Menge des Erdöls dieser Gegenden, mit deren Alter und deren Lagerung in einem bestimmten Zusammenhange.

Eine Analyse der Quelle des neuen Seebades zu Melle (zwischen Löhne und Osnabrück) führte Wilh. Thörner aus. (Rep. analyt. Chem. 3, 22.) Das Wasser besitzt eine Temperatur von 15·5° C. bei 19·5° C. Luftwärme. Die Soole enthält freie mechanisch beigemengte Gase,

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welche aus 29·20 Vol.-Proc. Kohlensäure, 0·80 Vol.-Proc. Sauerstoff und 70·00 Vol.-Proc. Stickstoff bestehen. In 1 l sind bei 0° und 760 mm B. 365·0 cbcm Gase absorbirt oder gelöst, 92·72 Vol.-Proc. Kohlensäure, 0·84 Vol.-Proc. Sauerstoff und 6·44 Vol. Proc. Stickstoff enthaltend. Das spec. Gew. des Wassers bei 19·0° C. beträgt 1·0225; in 1 l Wasser befinden sich 28·558 Tle. Trockensubstanz (bei 160° getrocknet), bestehend aus:

Calciumsulfat	4·0275 ‰	Chlorammonium	0·0142 ‰
Strontium „	0·0420 „	Calciumphosphat	0·000043 „
Natrium „	3 3683 „	Calciumcarbonat	0·08644 „
Kalium „	0·2027 „	Ferrocarbonat	0·00777 „
Chlornatrium	20·6941 „	Mangan „	0·00167 „
Chlorlithium	0·0023 „	Kieselsäure	0·01214 „
Chlormagnesium	0·8140 „	Titansäure	0·000025 „
Brom „	0·0004 „	Kohlensäure, freie	1·129 „
Jod „	0·00005 „		

Die Kronenquelle zu Salzbrunn in Schlesien enthält nach Th. Poleck (Journ. f. prakt. Chem. **27**, 45) in 1000 g Wasser.

Chlornatrium	0·05899 g	Strontiumdicarbonat	0·00280 g
Natriumsulfat	0·18010 „	Mangan „	0·00181 „
Kalium „	0·04085 „	Eisen „	0·00913 „
Natriumdicarbonat	0·87264 „	Aluminiumphosphat	0·00036 „
Lithium „	0·01140 „	Thonerde	0·00047 „
Magnesium „	0·040477 „	Kieselsäure	0·03460 „
Calcium „	0·71264 „	Sa. des Rückstandes	2·33057 „

Beiträge zur Kenntnis der physiologischen Wirkungen dieser Quelle liefert Richard Gscheidlen. (Grass, Barth & Co., Breslau.)

Die Mineralquellen zu Slanik in Rumänien hat S. Konya untersucht. (Ber. Chem. Ges. **15**, 1775.) Die drei salzigen Mineralwässer gehören zu den alkalisch-muriatischen kohlensäurereichen Quellen mit viel Soda und Kochsalz, geringem Jod- und Bromgehalt, wie Selters, Ems u. s. w. und sind qualitativ gleich, quantitativ sehr verschieden zusammengesetzt. Die Eisenquellen gehören zu den kohlensäurehaltigen Eisensäuerlingen mit sehr geringem Gehalt an festen Bestandteilen; nur Eisen, Mangan sind in Form von Bicarbonaten enthalten. — A. Terreil hat in 60 l des Mineralwassers von Montroud (Loire), (Compt. rend. **96**, 1581), welches im Jahre 1881 in einer Tiefe von 502 m angebohrt wurde und durch Kohlensäuredruck bis mehrere Meter über die Oberfläche sprudelte, aufgefunden: CO^2 frei 0·9356 g = 473 cbcm, CO^2 gebunden 2·1994 g, Na^2O 1·5408 g, CaO 0·0336 g, MgO 0·0224 g, FeO 0·0118 g, Cl 0·0390 g, P^2O^5 0·0005 g, As^2O^5 0·0003 g, SiO^2 0·0386, K^2O, Li^2O, Al^2O^3, SO^3 und J Spuren, organische stickstofffreie Substanz 0·009 g.

Das bei Srinye-Lipoiz im Saivser Comitate vorkommende Mineralwasser, das seit einiger Zeit im Handel als „Salvator“ zu bekommen ist, ist nach M. Ballo (Ber. d. chem. Ges. **15**, 3003) reich an freier Kohlensäure

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und an kohlensauren Salzen des Kalkes, der Magnesia, des Natron und Lithion. Es enthält im Liter 2·326 g an Gesamtsalzen, 1·046 g an $CaCO^3$, 0·5276 g an $MgCO^3$, 0·1927 an Na^2CO^3, 4·00365 g an Gesamtkohlensäure, wovon 2·35571 g ganz frei, der Rest (2 × 0·82397 g) an die genannten Basen zu doppeltkohlensauren Salzen gebunden ist. Die der Salvatorquelle reichlich entströmenden Gase bestehen aus 96·4 Proc. Kohlensäure, 3·6 Proc. Stickstoff, ausserdem Spuren von Sumpfgas und Sauerstoff. Die übrigen Bestandteile sind schwefelsaures Natron und Kali, Natriumborat, -chlorid, -bromid und -jodid, Thonerde und Kieselsäure. Eisen ist nicht nachweisbar. Trotz der grossen Menge von Kohlensäure mussirt das Wasser bei 8—10° R. nicht und bei höherer Temperatur nur schwach, weshalb Verf. glaubt, dass die Kohlensäure als Hydrat darin vorhanden ist.

In 1000 g des Wassers des Oberbrunnen zu Flinsberg in Schl. sind nach Th. Poleck (Pharm. Ztg. d. Corresp. Bl. d. Ver. Miner. Wasserfabrik. **1**, 112) enthalten:

Chlorkalium	0·00258 g	Magnesiumbicarbonat .	0·12595 g
Chlornatrium	0·00614 „	Eisen	0·03744 „
Kaliumsulfat	0·01041 „	Mangan	0·00103 „
Natriumbicarbonat . .	0·07374 „	Aluminiumphosphat . .	0·00087 „
Lithium	0·00185 „	Kieselsäure	0·03995 „
Ammon	0·00172 „	Titansäure	0·00026 „
Calcium	0·15629 „	Sa. .	0.45823 g
		Kohlensäure, halbgebunden .	0·22064 g
		„ freie . .	2·54326 g.

ausserdem unwägbare Mengen Jod, Borsäure, Arsensäure, Antimon, Zinn, Nickel, Wismuth, Barium und Strontium. Der Quellsatz enthält über 3 Proc. Titansäure, deren Vorkommen sich ungezwungen auf die Eisentitanate, die Iserine des Iserkammes, an dessen Fusse die Quelle entspringt, zurückführen lässt. — H. Fleck (X. und XI. Jahresber. d. Centralstelle f. öffentl. Gesundheitspfl. zu Dresden 1882, 58; Ber. d. chem. Ges. **15**, 2931) fand die Temperatur des Mineralwassers von Gruben bei Scharfenberg, unweit Meissen bei 9·5° C. (Lufttemp. 11·4° C.), das spec. Gewicht zu 1·0022 bei 15° C. Ein Liter Wasser liefert 2·3053 g Rückstand, bestehend aus:

1·4545 g	Calciumsulfat.	0·0690 g	doppelkohlens. Magnesia,
1·0115 „	doppeltkohlensaurer Kalk,	0·0015 „	„ Ammoniak,
0·0081 „	„ Zink,	0·2345 „	„ Magnesiumchlorid,
0·0004 „	„ Kupfer,	0·0282 „	„ Kalium „
Spur von	„ Cobalt,	Spur von	„ Lithium „
0·1751 g	„ Eisen,	0·2767 g	„ Natrium „
0·0865 „	„ Mangan	0·0305 „	„ Natriumsilicat,
0·0011 „	„ Baryt,	0·0101 „	„ Kieselsäure.
0·0116 „	„ Strontian,		

Diese Quelle ist zur Zeit als die Eisen- und Mangan-reichste unter allen bis jetzt bekannten Heilquellen zu betrachten. — In Slawinsk, drei

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Werst nördlich von der polnischen *Gouvernementstadt Lublin*, befinden sich zwei zu den besten eisenhaltigen Mineralwässern gehörende Quellen, die eine constante Temperatur von 9·5° C. besitzen. Die sogenannte grosse Quelle „Bolschoi" wird zu Bädern, das Wasser der Quelle „Kasimir" zum Trinken benutzt. (Orlowsky, Journ. russ. chem. Ges. 1883, 75.)

Die eisenhaltige Mineralquelle von Rosenau im Comitat Gömör in Ungarn ist nach Alex. Kalecsinszky (Zeitschr. d. Ungar. Geolog. Ges. **13**, d. chem. Centrbl. (3). **14**, 569) schwach sauer und von starkem Eisengeschmack. Temperatur zwischen 13 und 14° C. (bei Lufttemp. 20—25°); spec. Gew. 1·00023. 10,000 Tle. Wasser enthalten:

Kohlensaures Natrium	0·5479 g	Natriumchlorid	0·0245 g
„ Calcium	0·4444 „	Aluminiumhydrat	0·0052 „
„ Magnesium	0·5062 „	Jodverbindungen	Spuren
„ Eisen	0·2762 „	Organische Stoffe	Spuren
Kieselsäurehydrat	0·2059 „	Freie und halbgebundene Kohlensäure . .	2·6937 „
Schwefelsaures Calcium	0·0730 „	Summe der im Wasser aufgelösten Bestandteile	4·8308 g.
Kaliumchlorid	0·0273 „		
Kohlensaures Mangan	0·0265 „		

J. Lefort (Journ. Pharm. Chim. (5) **8**, 14) teilt die Analyse des Mineralwassers von Heucheloup mit.

Filhol (Bull. de l'Acad. de Méd. (2) **12**, No. 13, 393) hat die Schwefelwässer von Veux-Gamarde (oder von Buccurron) analysirt.

Derselbe (Bull. de l'Acad. de Méd. (2) **12**, No. 13, 390) teilt die Analyse der Thermen (und des Moores) von Dax mit.

Die heissen Quellen am Amur bei Neu-Michaelowsk im Bezirke Nicolajefsk hat Baron von Löhdorf (Pharm. Ztschrft. f. Russland 1883, 20) untersucht. Die Temperatur der Quellen liegt zwischen 31 und 39° R., das spec. Gewicht des Wassers bei 15° C. ist 1·0011. 1 Liter Wasser enthielt 0·2040 unverbrennliche Stoffe, 0·0520 verbrennliche, organische -N- freie Stoffe, 0·2910 feste Bestandteile. — J. C. Tresh (Chem. News **46**, 201) unterwarf von neuem die Thermalquellen von Buxton einer Analyse. (Vgl. Techn.-chem. Jahrb. 1883, S. 257.)

3. Wasserversorgung.

G. Janecek (Rad Jugoslav a Rad. **61**, 185) teilt sechs Analysen des Agramer städtischen Leitungswassers (Grundwasser der Save?) mit; das Wasser dazu wurde in dem Jahre 1880 zu verschiedenen Jahreszeiten und unter verschiedenen Witterungsverhältnissen, darunter eine bald nach dem grossen Erdbeben vom 9. November 1880, entnommen. Das Erdbeben hatte auf die Zusammensetzung des Wassers keinen Einfluss. Die Härte betrug 20·5°. — Den Einfluss des Elbwassers auf die Zusammensetzung des Leitungswassers von Dresden studirte H. Fleck (X. u. XI. Jahresber. d. k. Chem. Centralstelle f. öffentl. Gesundheitspfl. 54). Der Arbeit sind: 1) eine Tabelle über die durchschnittliche Menge der in einem Liter

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lin, b[illegible]ngswasser und Elbwasser gelösten Bestandteile während der einzelnen de[illegible]onate des Jahres 1879, 1880 und 1881 beigefügt, 2) zwei Curventafeln, von denen die eine die Schwankungen des Schwefelsäuregehaltes von Elb- und Leitungswasser, die andere die Differenzen im Magnesiagehalte beider Wassersorten während der einzelnen Monate dieser drei Jahre darstellt. — Die Analysen einiger Moskauer Wässer publicirt P. Grigorjew (Journ. d. russ. phys.-chem. Ges. 1882 (1), 328 d. Ber. chem. Ges. **16**, 88). Moskau erhält täglich nur 635 000 Wedro guten Wassers.

Ueber die Trinkwasserverhältnisse der Stadt Osnabrück berichtet Wilhelm Thörner (Sep. Abd. aus dem V. Jahresber. des naturw. Vereins daselbst). Auf Grund von 99 Brunnenuntersuchungen weist der Verfasser nach, dass das Trinkwasser der Stadt sehr schlecht sei.

Die chemische und mikroskopische Untersuchung einer Anzahl (571) von Brunnenwasser der Stadt Braunschweig mit Rücksicht auf deren Verwendbarkeit zu Trinkwasser ist von R. Frühling, Julius Schulz und B. Eyferth (Braunschweigische Anzeigen 1882, No. 191) ausgeführt worden. Darnach liefert die weitaus grösste Mehrzahl der Stadtbrunnen schlechtes Trinkwasser.

Die Festschrift zur 23. Jahresversammlung des deutschen Vereins von Gas- und Wasserfachmännern (Berlin 1883, Springer), dargebracht vom Ortsauschusse, giebt eine ausführliche Beschreibung der Wasserversorgung der Stadt Berlin.

Gegenüber der Meinung, dass Bleiröhren durch einen geringen Gehalt des Wassers an Schwefelsäure nicht so leicht angegriffen werden (Chem. News. **46**, 88), weist A. Allen (ibid. **46**, 145) darauf hin, dass Bleisulfat mehr als doppelt so löslich ist als kohlensaures Blei, welch' letzteres sich bei der Einwirkung von Brunnen- oder Leitungswasser auf die Bleiröhren zu bilden pflegt. Wasser, dem Spuren von Schwefelsäure zugesetzt waren, löste mehr Blei, als Wasser von neutraler oder nur äusserst schwach saurer Reaction. In einem Chloride enthaltenden Wasser wird zudem durch Zusatz von Schwefelsäure Salzsäure frei werden. — Gautrelet (Repert. de Pharm. **11**, 10; Arch. d. Pharm. (3) **21**, 457) fand in einem Brunnenwasser, welches verdächtig war, die Vergiftung mehrerer Personen veranlasst zu haben, Blei vor. Das Bleirohr hatte bereits 28 Jahre lang für die Leitung gedient. Nach Abnahme desselben, und nachdem es durchschnitten war, zeigten sich im Innern zwei von einander verschiedene concentrische Lager, von denen die eine aus Calciumcarbonat und Bleihydrocarbonat, die andere aus Oxyden und Carbonaten von Blei und Eisen bestand.

Das auf der Hygiene-Ausstellung in Berlin vorhandene Material betreffend die Wasserversorgung, war ein so reichliches, dass wir an dieser Stelle nur einzelner Gegenstände gedenken können.

Eine Zusammenstellung von Wasser-Analysen als Beitrag zu einer Wasserstatistik Schleswig-Holsteins ist von A. Emmerling veröffentlicht worden. Die Untersuchungen sind in den Jahren 1872

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bis 1882 angestellt. Eine grosse Anzahl von Städten hat Pläne, Modelle, Drucksachen über ihre Wasserversorgung ausgestellt; erwähnt seien Berlin, Wien mit seiner Hochquellenwasserversorgung, Hamburg, Bunzlau, Dresden, Breslau, Karlsbad. Hulwa hat die Beschaffenheit des Oderwassers oberhalb, innerhalb und unterhalb Breslau dargestellt.

4. Reinigung des Wassers für häusliche und gewerbliche Zwecke.

Eine Zusammenstellung der verschiedenen in Vorschlag gebrachten Reinigungsverfahren für Wasser giebt P. Lohmann im Corresp.-Blatt des Vereins deutscher Mineralwasser-Fabrikanten 1, No. 4 und 5.

Das Verfahren zum Desinficiren und Reinigen des Wassers und anderer Flüssigkeiten von suspendirten Stoffen von E. Reidemeister in Magdeburg (D. P. 21210 vom 2. Juli 1882) stützt sich darauf, dass übermangansaures Kali und Wasserstoffsuperoxyd sich unter Abscheidung von freiem Sauerstoff zersetzen, und sich hierbei in neutralen oder basischen Lösungen ein voluminöser, sich leicht absetzender Niederschlag (von Manganoxydhydrat) bildet, welcher die suspendirten Stoffe umhüllt, so dass diese nunmehr vollständig durch gewöhnliche Filtration zurückgehalten werden können. Dieser Niederschlag bildet sich schon unter Anwendung von ausserordentlich geringen Mengen von Chamäleonlösung unter Zusatz von dem halben Gewichte Wasserstoffsuperoxyd. Der Niederschlag entsteht in gleicher Weise, nur meist unter Anwendung grösserer Mengen der obigen Chemikalien, in den Effluvien aller Art, so dass bei dem verhältnismässig geringen Preise jener Stoffe und unter Berechnung der teilweise noch benutzbaren Niederschläge eine allgemeine Einführung ermöglicht ist. — Wald. Zimmermann beschreibt (Gesundheits-Ingen. 5, No. 23) die Schnellfiltration nach Piefke's System. Das Filter besteht aus einem cylindrischen Gefäss, in welchem eine Anzahl kreisförmiger Siebe horizontal über einander angeordnet ist. Die Siebe bilden die Bodenflächen von Kammern und dienen als Träger des Filtrirmaterials. Die Leistung des auf einer und derselben Grundfläche aufgebauten Filters wächst mit der Anzahl der Siebe bezw. Kammern. Apparate von 5 cbm stündlicher Leistung z. B. enthalten 12 Siebe in Abständen von je 60 mm. Als Filtrirmaterial dient eigens präparirte Cellulose; dasselbe reinigt in 24 Stunden pro Quadratmeter Filterfläche 50—60 cbm Wasser. Wenn die zersetzenden Einflüssen an und für sich zwar resistenzfähige Cellulose mit faulenden Stoffen in Berührung kommt, wird sie zudem noch mit antiseptischen Stoffen imprägnirt. — C. W. Rabitz in Hamburg-Eimsbüttel construirte einen Filtrirapparat für Wasser. (D. P. 21768 vom 10. September 1882.) Ein das Filtermaterial enthaltender Korb ist frei in das Gehäuse eingesetzt. Derselbe wird unten und an den Seiten vom Wasser umspült und ist nur oben gegen die Gehäusewandung abgedichtet. Nach Lösen eines Bügels kann der Korb unten aus dem Gehäuse herausgenommen werden. Das Wasser tritt unten in das Gehäuse, durchfliesst den Korb und strömt oben ab.

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Puhler und W. Sedlaczek beschreiben in der Wochenschr. d. Oesterr. Ingen.- u. Archit.-Vereins **8**, 100 eine Wasserreinigungs-Anlage zur Weichmachung und Klärung des Wassers für industrielle Zwecke. — Der Vorwärmer von G. S. Strong (Journ. of the Franklin Inst. 1882, **114**, 327) soll nicht nur das Calciumcarbonat, sondern auch das Calciumsulfat bei Temperaturen über 130° ausscheiden. — Auf ähnlichem Princip wie dieser Apparat beruht der Reinigungsapparat von J. Brion und Ig. v. Plattner in Wien. (D. P. 19932 vom 3. Januar 1882.)

A. Scerbaceff prüfte die Derschau'sche Methode der Wasserreinigung für Locomotiven.*) (Zurn. rusk. chim. obsc. **14**, 103; Chem. Centr.-Bl. (3) **13**, 829.) Anlässlich der von den russischen Südbahnen erhobenen Klagen, dass das nach der genannten Methode (mittelst Magnesia) gereinigte kochsalzhaltige Wasser die Kessel rasch zerstöre, unternahm Verfasser eine Reihe von Versuchen, deren Resultat ihn bestimmt, die Methode zu verwerfen.

Die in Baden-Baden abgehaltene Verbandsversammlung der Dampfkessel-Ueberwachungsvereine beschäftigte sich mit der angeblichen Wirkung des Zinks zur Verhütung von Kesselstein. Brauser ratet von der Verwendung dieses Metalls entschieden ab. Eckermann betont, dass die Zinkeinlagen nur Corrosionen des Kessels verhüten sollen, durchaus aber nichts mit der Verhütung von Kesselstein zu thun hätten. (Dingl. pol. Journ. **247**, S. 456.)

Ueber die chemische Zusammensetzung von Dampfkessel-Speisewässern und Kesselsteinen, sowie über die Wirksamkeit der gebräuchlicheren Antikesselsteinmittel von M. Jerson Macadam (Journ. Soc. Chem. Ind. 1883, 12; Chem. Ind. **6**, 54). Die Wässer, welche wesentlich Calciumcarbonat gelöst enthalten, liefern einen zerbrechlicheren und leichter zu entfernenden Kesselstein, als jene, die ausserdem noch Calciumsulfat enthalten. Die Zähigkeit des Kesselsteins hängt aber auch wesentlich von der Art ab, in der der Dampfkessel vor der Reinigung erkaltet; bei langsamer Abkühlung des Wassers gelingt die Ablösung der Incrustationen viel leichter. — Das beste Kesselspeisewasser stammt aus Torfmooren, das schädlichste liefern die sauren Grubenwässer, welche in Folge ihres Schwefelsäuregehaltes die Kesselwände stark angreifen und einen an Eisenoxyd und Gyps reichen Kesselstein liefern. Auch Seewasser wirkt stark wegen seines Chlormagnesiumgehaltes auf die Eisenwände des Kessels ein. Nach der chemischen Zusammensetzung zerfallen die Kesselsteinmittel: 1. in Salze, 2. Fette und Oele, 3. Paraffin und dessen Producte, 4. andere organische Substanzen. Unter den Salzen wird Soda am häufigsten angewandt; im Handel werden Antikesselsteinmittel, die im wesentlichen aus Soda bestehen, zu sehr hohen Preisen verkauft, so z. B. besteht ein in London viel gebrauchtes Mittel lediglich aus Sodakrystallen, die mit Lakmuspulver bestreut sind. — „Tripsa" ist tertiäres Natriumphosphat, mit dem Davis gute Resultate erzielt hat. Zuweilen werden auch Sulfite angewendet (Morgan's Antikesselstein). —

*) Techn.-chem. Jahrb. 1883, S. 270.

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Die fettigen Antikesselsteinmittel können nicht streng genug verurteilt werden. — Paraffinöl hat eine sehr günstige Wirkung, indem es einen weichen, leicht zu beseitigenden Absatz bewirkt; seine Wirkung ist offenbar eine rein mechanische. — Von anderen organischen Stoffen ist Torf und Moor in vielen Fällen von gutem Erfolg. — Baudet's Mittel*) soll ein grösseres Lösungsvermögen für Gyps bedingen und die unlöslichen Carbonate in gelatinöser Form fällen. — Bonneville's Mittel besteht aus Bariumcarbonat, Ammonnitrat, Kochsalz und Holzkohle. — Zink soll sich nur bei Seewasser gut bewährt haben.

Zum Schluss bespricht Verfasser die verschiedenen Methoden, das Wasser vor dem Einbringen in den Kessel zu reinigen, wozu einfache Erhitzung, Zusatz von Kalkmilch, Magnesia, Chlorbarium, dreibasisches Calciumphosphat oder Soda vorgeschlagen werden.

Das „Corrosiv" von L. Cohn & Comp. in Berlin besteht einer Analyse von L. Weineck zufolge aus Aetzkalk, Calciumcarbonat und Aetznatron. 100 kg kosten 97 ℳ, wirklicher Wert 9—10 ℳ. (Ind. Bl. 1883, No. 44.)

Die nachstehenden Analysen von 20 Geheimmitteln zur Verhütung des Kesselsteins, ausgeführt im Auftrage des Verbandes der Dampfkessel-Ueberwachungsvereine von dem chemischen Laboratorium der Heizversuchsstation in München, fanden sich auf der diesjährigen Hygiene-Ausstellung auf einer Tabelle ausgestellt (No. 1162 des Ausstellungskatalogs). Proben dieser Mittel waren den Analysen beigegeben.

1. Kesselsteinpulver von A. Albert in Berlin besteht aus: 26·14 Proc. Kreide, 21·04 Proc. Kochsalz, 24·13 Proc. Kalkhydrat, 8·17 Proc. Natriumhydrat, 8·28 Proc. Natriumsulfat, 1·22 Proc. Kieselsäure, 0·74 Proc. Eisenoxyd und Thonerde, 3·34 Proc. Wasser, 6·94 Proc. Leim (als Rest). Wert von 1 kg des Mittels, das dem Paralithicon minerale sehr ähnlich sieht, circa 15 Pf.

2. Kesselsteinpulver von J. C. Schwieger in Dessau besteht aus: 14·36 Proc. Soda, 12·50 Proc. Natriumsilicat, 0·92 Proc. Kochsalz und Glaubersalz, 0·75 Proc. Eisenoxyd und Thonerde, 12·49 Proc. Sand, 14·60 Proc. organischen Teilen, 44·23 Proc. Wasser. 100 kg bestehen somit aus 67 kg krystallisirter Soda (mit 63 Proc. Wasser), 19 kg Sand und 14 kg Braunkohlenpulver. 100 kg kosten 40 ℳ, während die einzelnen Bestandteile zusammen einen Wert von 10 ℳ besitzen. Durch Anwendung dieses Mittels wird der Kesselstein vermehrt und ausserdem das Kesselwasser verunreinigt.

3. Deutsche Kesselsteinlösung von Patrosio in Bochum. 1 l enthält: 84·30 g Soda, 15·20 g Aetznatron, 8·12 g Kochsalz, 5·00 g Glaubersalz, 27·168 g organische Teile; Summa 139·787 g. Rest ist Wasser. Besteht also aus Soda und Aetznatron mit etwas Kochsalz und Glaubersalz, vermischt mit einem Auszuge aus einem gerbsäurehaltigen Stoffe (Katechu, Lohrinde, Torf), Alles zusammen mit sechs Mal so viel Wasser verdünnt. — Ein Liter wird mit 26 Pf. verkauft, während die wesentlichen Bestandteile, Soda und Aetznatron, nur einen Wert von 4 Pf. pro Liter besitzen.

4. Kesselsteinlösung von J. Warkmann in Hamburg. 1 l = ca. 1000 g enthalten: 41·3 g Soda, 24·6 g Kochsalz, 16·2 g Bariumcarbonat, 6·6 g

*) Techn.-chem. Jahrb. 1883, S. 273.

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Calciumcarbonat, 6·7 g Salmiak, 0·6 g Sand, 20·4 g organische Teile: Summa 116·4 g; der Rest ist Wasser. Besteht somit im wesentlichen aus Soda, kohlensaurem Barium, Kochsalz und Salmiak, vermischt mit einem Auszuge aus einem gerbsäurehaltigen Abfallstoffe (Gerberlohe und dergleichen), Alles zusammen mit acht Mal so viel Wasser verdünnt. — Vor der Anwendung dieser Lösung muss gewarnt werden, da sie nicht nur das Kesselwasser verunreinigt, sondern wegen des Gehaltes an Salmiak und Kochsalz auf die Kesselwandung etc. zerstörend wirkt.

5. Kesselsteinspiritus von W. Friede in Hamburg. In 1 l = ca. 1000 g sind enthalten: 143·275 g Kochsalz, 10·481 g Salmiak, 3·317 g Kaliumchlorid, 5·046 g Kaliumcarbonat. 2·510 g organ. Substanz (Farbstoff), 4·550 g Ammoniak, 0·89 g Bariumcarbonat, 0·98 g unlösliche organische Teile: Summa 171·049 g; Rest, ca. 830 g, ist Wasser. Eine Kochsalzlösung, die Chlorammonium, etwas kohlensaures und freies Ammoniak enthält und rotbraun gefärbt ist. Alkohol ist nicht vorhanden. — Sämtliche Bestandteile müssen als geradezu schädliche bezeichnet werden.

6. Discorstante (Krustenreiniger). Erfinder: Prof. Tomm. Alfieri in Neapel. In 100 Gewichtsteilen des Pulvers sind enthalten: 73·85 Proc. Soda, 1·85 Proc. Kochsalz und Glaubersalz, 3·47 Proc. Thonerde, Kalk und Sand, 6·02 Proc. Pflanzenteile, 14·32 Proc. Wasser. Eine Gemenge von 74 Proc. Soda, 6 Proc. Pflanzenteilen (pulverisirte Sumachblätter oder dergleichen), 14 Proc. Wasser und 6 Proc. zufällige beziehungsweise verunreinigende Bestandteile. Der Wert für die in 1 kg des Mittels enthaltene Soda beträgt etwa 27 ₰, während dasselbe zu 2 ℳ pro Kilogramm verkauft wird.

7. The Disincrustant Marseillais, Lieferant: The disincrustant Company in Manchester. Die Flüssigkeit besitzt neutrale Reaction und ist nach ihrem Verhalten zu Leimlösung und Eisensalzen zu schliessen, ein wässriger Auszug eines Gerbstoffs, einigen Farbenreactionen nach wahrscheinlich Katechu. 1 l der Lösung enthielt 115·98 g Trockenrückstand, der 8·34 Proc. Asche hinterliess. Eine Probe von Katechuextract, die zum Vergleiche untersucht wurde, ergab 6·5 Proc. Asche. Aus Gipswasser und gewöhnlichem Brunnenwasser werden bei Zusatz dieses Mittels bei Siedetemperatur keine festen Bestandteile abgeschieden, ebensowenig wurde ein Kesselstein, welcher hauptsächlich aus kohlensaurem Kalk bestand, durch das Mittel aufgelöst. Das Mittel kann als nutzlos bezeichnet werden.

8. Désincrustant „Ragosine". Lieferant: Société V. J. Ragosine & Co. in Paris. Die chemische Untersuchung ergab, dass das Mittel als Rückstand aus der Darstellung von mineralischen Schmierölen (Petroleumteer) zu bezeichnen ist, und als Ueberzug auf der Kesselwandung ganz ähnlich wirkt, wie ein Anstrich mit gewöhnlichem Teer. Der Preis pro 100 kg des Mittels ist in der Schweiz mit 34 Frcs. angesetzt, während schwerer Steinkohlenteer etwa mit dem achten Teil dieses Preises zu haben ist.

9. Alkalisirte Cellulose von J. A. Pilgram in Barmen. In 100 Gewichtsteilen sind enthalten: 41·79 Proc. Wasser, 44·62 Proc. Soda, 2·71 Proc. Natriumhydrat, 11·49 Proc. Organisches. Sonach ist die „alkalisirte Cellulose" ein Gemenge von ätzend gemachter Soda mit Stärke, die letztere dem Anscheine nach in Form von Kleie beigemischt. Die Wirkung des Mittels auf die Abscheidung der kesselsteinbildenden Bestandteile des Wassers ist dieselbe, wie die von käuflicher Soda, jedoch erhält das Wasser in Folge der Kleisterbildung aus dem Stärkemehl die Eigenschaft, zu schäumen, was den Kesselbetrieb nur erschweren kann. — Der reale Wert pro 100 kg der alkalisirten Cellulose ist gleich ca. 15 ℳ, während im Prospect 90 ℳ als Preis pro 100 kg angeführt ist.

10. Lapidolyd von Gebr. Kolker in Breslau. Die Zusammensetzung

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schwankt in der Menge der angewandten Bestandteile sehr bedeutend. Von vier verschiedenen Proben enthielt 1 l = ca. 1000 g: 10—38 g Soda, 9—14 g Aetznatron, 0—9 g Natron gebunden, bis 8 g Kochsalz, 28—36 g organische Teile (Katechu und dergleichen): Summa 47—105 g; der Rest ist Wasser. Das Mittel besteht somit im wesentlichen aus Soda und Aetznatron sowie etwas Kochsalz, vermischt mit einem Auszuge aus einem gerbsäurehaltigen Stoffe (Katechu, Lohrinde), Alles zusammen in 10—20 Mal so viel Wasser gelöst. — 1 l Lapidolyd wird mit 20 ₰ verkauft; Wert der Soda und des Aetznatrons in 1 l nur 4—5 ₰.

Nach Dupré (Wochenschrift des Ver. deutsch. Ingen. 1882, 282) besteht dieses Mittel aus 2·7 Proc. Soda, 0·6 Proc. Kochsalz, 0·24 Proc. Natiumsulfat, 1·55 Proc. organ. Stoffe (Gerbsäure), 94·91 Proc. Wasser. (Vergl. hierzu Dingl. pol. Journ. 247, 456.)

11. Französisch-metallisches Product der Compagnie anonyme, Villeneuve. In 100 Gewichtsteilen sind enthalten: 56·00 Proc. Kalk, 42·70 Proc. Kohlensäure, der Rest von 1·30 Proc. besteht aus Wasser, in Salzsäure Unlöslichem (Thon), Spuren von Chlor, Magnesia und Natron. Das Mittel ist daher pulverisirte Kreide und vermehrt nur die Menge des Kesselsteins, statt demselben entgegen zu wirken. (Die Gesellschaft lässt sich für 100 kg des Mittels 195 ℳ bezahlen. (Vgl. Dingl pol. Journ. 247, 456.)

12. Kastanien-Extract zur Verhütung von Kesselsteinen, geliefert aus Esseg in Ungarn. Die chemische Untersuchung ergab, dass dasselbe in der That ein Extract von Rosskastanien ist und keinerlei Beimengungen von fremden Salzen enthält. Gypslösung wird nicht davon gefällt, nach Zusatz von Ammoniak entstand ein brauner Niederschlag. Wenn demnach unter Umständen auch eine Ausfällung der Kalksalze durch dieses Mittel eintreten wird, so ist dasselbe gleichwohl als Zusatz zum Kesselspeisewasser nicht zu empfehlen, erstens, weil mit dem Extract eine grosse Menge wirkungsloser organischer Substanzen, die das Wasser verunreinigen, in den Kessel kommen und zweitens, weil der gleiche Zweck besser mit Soda u. dgl. erreicht wird.

13. Universalmittel gegen Kesselstein, verkauft von dem Werkmeister der Gasfabrik in Linz a. d. Donau. Das Mittel enthält 95·79 Proc. organische verbrennbare Substanz mit 4·21 Proc. Asche, die in qualitativer und quantitativer Beziehung mit der eines Torfes nahe übereinkommt. Sie besass alkalische Reaction und enthielt auf 100 Teile des Kesselmittels bezogen 1·62 Proc. in Salzsäure lösliche Teile (Silicate, Thon); ferner 0·89 Proc. Thonerde mit Phosphorsäure neben geringen Mengen Magnesia (0·17 Proc.), Calciumcarbonat (0·89 Proc.) und Salze der Alkalien (0·73 Proc.).

Die ursprünglich braune Substanz mit Wasser aufgeschlämmt, setzte sich nach einiger Zeit zum grössten Teile wieder ab und verwandelte das Wasser in eine durchsichtige braune Flüssigkeit von neutraler Reaction, die beim Abdampfen sauer wurde und auf 100 Teile des angewandten Pulvers 3·7 Teile Abdampfrückstand in Form einer braunen Schmiere von saurer Reaction hinterliess. Gerbsäure war nicht vorhanden (Abwesenheit von Lohe). Dieses Verhalten entspricht dem Wasserauszuge von Torfpulver (Humussäure).

Das Mittel ist somit gewöhnlicher Torf und wirkt sogar schädlich, weil es das Wasser verunreinigt und zum Durchbrennen der Feuerplatten Anlass geben kann.

14. Kesselsteinmittel von Neddermann in Strassburg. Die wässrige Lösung des Mittels reagirte nicht alkalisch, enthielt demnach keine Soda, nur Spuren von Kochsalz. Die feste Substanz schmolz bei 117 bis 125° C., hinterliess 3 Proc. Asche, alles übrige war verbrennlich. Einigen Farben-

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reactionen nach, sowie nach dem Verhalten gegen Leimlösung und Eisenchlorid zu urteilen, ist dasselbe ein eingedampfter Auszug von Katechu-Abfällen. Der Schmelzpunkt von Katechu-Extract liegt zwischen 116 bis 120° C. — Aus Gypswasser oder Brunnenwasser, selbst bei Siedehitze, werden durch das Mittel feste Bestandteile nicht abgeschieden; ebensowenig wurde ein hauptsächlich aus Calciumcarbonat bestehender Kesselstein gelöst.

Eine günstige chemische Einwirkung auf die kesselsteinbildenden Bestandteile des Wassers kann diesem Mittel nicht zugesprochen werden, weshalb von seiner Verwendung abzuraten ist.

15. Kesselsteinlösung von J. Hauff in Feuerbach bei Stuttgart. Sie besteht aus einer Lösung von Aetznatron, verunreinigt mit Kochsalz und Natriumsulfat, und ist rot gefärbt. In 1 l oder 1 kg enthält die Lösung ca. 300 g Aetznatron, welche ca. 11 ℳ kosten, während 100 kg der Hauff'schen Lösung zu 30 ℳ verkauft werden.

16. Composition zur Verhütung der Kesselsteinbildung von Theodor Heime in Halle a. S. 100 Gewichtsteile enthalten: 15·49 Proc. Wasser, 5·14 Proc. Asche, 79·67 Proc. organische Bestandteile. Der Schmelzpunkt liegt bei ca. 100°. Die wässrige Lösung ist schwach sauer, wird mit Leimlösung und Eisenchlorid gefällt und enthält somit Gerbsäuren. — Gypswasser wird nicht gefällt, Kesselstein unter Auflösung einer geringen Menge Kalk schwach angegriffen. Die Composition ist ein unreines Pflanzenextract, nach allen Anzeichen ein abgedampfter Auszug von Katechu-Abfällen. Dieses unreine Extract kostet 110 ℳ, während reiner Katechu mit 95—100 ℳ pro 100 kg zu kaufen ist.

Die Verwendung von Katechu und ähnlichen Compositionen, wie die vorliegende, gegen die Bildung von Kesselstein, kann als rationell nicht bezeichnet werden, da deren Wirkung jedenfalls eine weit geringere und die Kosten höhere sind, als bei Verwendung rationeller Reinigungsverfahren mit Aetzkalk, Soda etc.

17. Antikesselstein-Composition von Bernhard Petrik & Comp. in Bodenbach a. E. 1 l = ca. 1000 g enthalten: 170·32 g kohlensaures und gerbsaures Natrium, 7·61 g Kochsalz, 17·07 g Natriumsulfat, 6·58 g in Wasser Lösliches, 228·42 g organische Teile: in Summa 430·00 g; Rest mit 570 g ist Wasser. Somit ist diese Composition eine concentrirte Lösung unreiner Soda, die mit Orseille blauviolet gefärbt ist und mit gerbsäurehaltigen organischen Substanzen (Katechu-Abfälle, Lohrinde oder dergl.) versetzt ist. — Ist die Lösung so stark, wie die analysirte, so beträgt der Wert der Substanzen ca. 27 ℳ pro 100 kg, während die Quantität derselben zu 40 fl. per Cassa ab Bodenbach verkauft wird.

18. Kesselstein-Gegenmittel von S. Engel in Posen. 1 l = ca. 1000 g enthalten:

67·46 g	Soda,	
32·11 „	Natron frei und an Gerbsäure gebunden,	
7·22 „	Natriumchlorid,	Verunreinigungen der Soda
5·48 „	Natriumsulfat,	
4·92 „	in Wasser Unlösliches,	
103·18 „	organ. Bestandteile	

Sa. 220·37 g; Rest mit ca. 780 g ist Wasser.

Gemisch aus unreiner Soda mit Auszug gerbsäurehaltiger Stoffe. Preis pro 100 kg 49 ℳ gegenüber ca. 16 ℳ., wenn man die organische Substanz als Katechu rechnet.

19. Kesselstein-Gegenmittel mit Salzmischungen von S. Engel in Posen. 100 Gewichtsteile enthalten: 51·00 Proc. Soda,

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27·60 Proc. Kochsalz, 19·77 Proc. Wasser, 1·63 Proc. Unlösliches und Natriumsulfat. Mithin $^3/_4$ unvollständig entwässerte unreine Soda und $^1/_4$ Kochsalz. — 100 kg werden mit 34 ℳ verkauft, gegenüber 20 ℳ. für calcinirte Soda. Das Mittel ist, wenn man Preis und Wirksamkeit in Betracht zieht, drei Mal teurer als calcinirte Soda. Ausserdem kann der Zusatz von 25 Proc. Kochsalz nur eine schädliche Wirkung für den Kessel haben.

20. Paralithicon minerale von Bernhard Lehmann in Altona, besteht aus: 34·21 Proc. Soda, 3·91 Proc. Kochsalz, 10·65 Proc. Natriumsulfat, 36·22 Proc. unlösliche Teile, 7·05 Proc. Wasser, 7·26 Proc. organische Teile. Somit ist das Paralithicon minerale unreine Soda mit mehr als $^1/_3$ seines Gewichts in Wasser und Salzsäure unlöslichen Substanzen: Thon, Kieselguhr, oder dergl. Letztere sind nicht nur für die Abscheidung der Kesselsteinbildner völlig unwirksam, sondern vermehren noch die Menge des Kesselsteins. — Das Pulver wird mit 120 ℳ für 100 kg verkauft, während die darin enthaltene Soda nur einen Wert von ca. 9 ℳ besitzt.

Ferd. Fischer (Dingl. pol. Journ. **247**, 457) berichtet noch über zwei andere Mittel. Das eine wird von S. Weber in Chemnitz zu 80 ℳ per 100 kg in den Handel gebracht und besteht aus 10·20 Proc. Wasser, 4·10 Proc. Sägespäne und sonstige organische Stoffe, 49·20 Proc. in Wasser lösliche Salze (unreine Soda), 4·34 Proc. in Salzsäure löslich (Al^2O^3 0·13 Proc., $CaCO^3$ 3·79 Proc., $MgCO^3$ 0·42 Proc.), 31·84 Proc. unlöslich (Sand etc.), in Summa 99·68 Proc. Der wirkliche Wert dieses Gemenges stellt sich 100 kg auf etwa 8 ℳ.

Das zweite Mittel ist das von L. Javal frères in Hamburg als Antikesselsteinextract (f. 100 kg 80 ℳ) in den Handel gebrachte. Es bildet eine glänzend braunschwarze ziemlich zähe Masse, deren Geruch an Fliedermuss (Sambucus nigra) und Löwenzahnextract (Taraxacon off.) erinnert. In der Asche (2·35 Proc.) sind die Bestandteile eines beliebigen Pflanzenextractes enthalten, dessen Identität festzustellen der Verf. nicht der Mühe für wert hielt. Versuchen zufolge kann von einer Reinigung des Kesselwassers durch das Javal'sche Mittel nicht die Rede sein. Wohl aber würden Ventile etc. dadurch gründlich verschmiert werden, so dass vor Anwendung desselben gewarnt werden muss.

5. Untersuchungsmethoden.

G. Wolffhügel u. F. Tiemann (Deutsche Viertelj.-Schrift f. öffentl. Gesundheitspflege **15**, 552; Pharm.-Centrh. **24**, No. 23 u. 24) stellen in Bezug auf die hygienische Beurteilung der Beschaffenheit des Trink- und Nutzwassers folgende Thesen auf: 1. In allgemein gültigen ziffernmässigen Normen (Grenzwerten) lässt sich nicht angeben, bis zu welcher Menge Wässer von verschiedenen Orten und Bezugsarten einzelne Bestandteile enthalten dürfen, ohne dass sanitäre Bedenken gegen die Verwendbarkeit derselben als Trink- und Nutzwasser zu erheben sind. 2. Für die Beurteilung des Grades der Reinheit ergeben sich geeignete Anhaltspunkte durch Vergleich des analytischen Befundes mit der Zusammensetzung von Wässern der nämlichen Gegend und Bezugsart, welche nachweislich nicht verunreinigt sind. 3. Zur Beschaffung von Grundlagen für solche Vergleiche sind ausgedehnte Erhebungen über die Zusammensetzung der reinen natürlichen Wässer unter Anwendung einheitlcher analytischer Verfahren erwünscht.

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Vom Gesundheitsamte wird folgende Methode der Untersuchung des Wassers auf Mikroorganismen ausgeführt. (Verh. d. D. Ver. f. öff. Gesundheitspflege; Pharm. Centrh. **24**, No. 35.) Zur unmittelbaren mikroskopischen Prüfung wird ein Tropfen des betreffenden Wassers, nachdem dasselbe stark geschüttelt war, auf ein Deckglas gebracht, letzteres mit dem nach unten gerichteten Tropfen auf einen hohlgeschliffenen Objectträger gelegt und bei 100facher, darauf bei 500facher Vergrösserung durchgemustert. Es werden ferner mehrere Deckgläschen mit einem Tropfen desselben Wassers versehen und zum Eintrocknen der Flüssigkeit an einem geschützten Ort aufbewahrt. Nach dem Verdunsten des Tropfens, was nach 15 bis 20 Minuten der Fall, findet eine Färbung der den Deckgläschen anhaftenden trockenen Substanz mit Methylenblaulösung statt; darauf werden die Deckgläschen wiederum getrocknet, in Canadabalsam eingelegt und alsdann bei 500facher Vergrösserung untersucht. Die im Wasser befindlichen Bacterien nehmen hierbei das Methylenblau auf und sind unter dem Mikroskop leicht sichtbar. Um die Zahl der im Wasser befindlichen entwickelungsfähigen Mikroorganismen zu bestimmen, wird eine entsprechende Menge Wasser mit flüssig gemachter und unmittelbar vorher in Siedehitze sterilisirter Nährgelatine*) vermischt. Die Menge des hierbei zu verwendenden Wassers muss durch Vorversuche betimmt werden und schwankt zwischen $^1/_{1000}$ Tropfen und 10 Tropfen. Die Tropfenzahl wird stets mit derselben Pipette abgemessen; letztere muss jedesmal mehrfach mit gekochtem, destillirtem Wasser und dann noch mehrere Male mit dem zu untersuchenden Wasser ausgespült werden. Die Pipette ist so graduirt, dass 1 cbcm 22 Tropfen Wasser entspricht. Zur Mischung mit dem Wasser dienen bei jeder Untersuchung 10 cbcm verflüssigter Gelatine, welche sofort auf einer horizontal gelagerten, vorher durch Hitze desinficirten Glasplatte ausgebreitet werden. Die Manipulation wird in einem kalten Raume ausgeführt, so dass die Gelatine nach wenigen Minuten erstarrt. Die Platte wird hierauf in eine feuchte Glocke gelegt und in einem geheizten Zimmer aufbewahrt. Es entwickelt sich dann im Laufe von 40 bis 60 Stunden eine der im Wasser enthaltenen Mikroorganismen entsprechende Anzahl von Colonien in Form von mehr oder weniger grossen, verschieden gefärbten, die Gelatine hin und wieder verflüssigenden Punkten und Tropfen. Die Zahl dieser Colonien wird in der Weise bestimmt, dass unter die Glasplatte eine zweite Glasplatte mit eingeätzten Quadrat-Centimetern gelegt wird. Die zur Entwickelung gekommenen Colonien werden auf verschiedenen Stellen der Platte mit Hilfe des Mikroskops bei 30facher Vergrösserung gezählt und hiernach die Durchschnittszahl derselben bestimmt. Die Anzahl der Quadratcentimeter, welche die Fläche der ausgebreiteten Gelatineschicht einnimmt, wird mit der genannten Durchschnittszahl multiplicirt. Es ergiebt sich hieraus die Zahl der entwickelungsfähigen Organismen, welche in dem der

*) Die Nährgelatine bereitet man aus Fleischinfus, welchem 1 Proc. trocknes Pepton, 0·5 Proc. Kochsalz, 5 Proc. Gelatine und ein bestimmtes Quantum kohlensaures Natron bis zur Neutralisation zugefügt ist.

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Gelatine zugesetzten Quantum des zu untersuchenden Wassers enthalten sind, so dass daraus die Zahl der in einem cbcm dieses Wassers vorhandenen Keime berechnet werden kann. Diese Zahl hat zwar nur einen Anspruch auf annähernde Richtigkeit; dieselbe fällt jedoch jedenfalls geringer aus, als es der Wirklichkeit entspricht, da mehrere unmittelbar zusammenliegende Keime in eine Colonie zusammenfallen und manche Mikroorganismen, trotz der für die meisten Bacterien und Pilze sehr günstigen Beschaffenheit des Nährbodens, auf demselben nicht zur Entwickelung kommen werden.

Die in der Methode liegenden Fehlerquellen bewegen sich in sehr engen Grenzen. Bei wiederholten Versuchen in denen gekochtes, destillirtes Wasser auf einer Nährgelatine untersucht wurde, betrug die Anzahl der aus einem cbcm dieses Wassers gezüchteten Colonien 4 bis 6, eine Zahl, welche gegenüber der grossen Anzahl von Colonien, welche in den untersuchten Wasserproben zur Entwickelung gelangten, verschwindend klein ist.

Als ein besonderes Kriterium für die Beurteilung eines Wassers ist allgemein der Gehalt desselben an gelöster organischer Substanz anerkannt. Wenn daher ein Wasser viel belebte, organisirte und entwickelungsfähige Elemente (Bacterien) enthält, so ist zweifellos, dass in demselben auch eine hinreichende Quantität organischer, als Nährsubstanz für diese Wesen dienender Stoffe enthalten sein muss. Es liegt somit nahe, dass der Gehalt an entwickelungsfähigen organisirten Keimen seiner Zahl nach einen Rückschluss auf den Gehalt eines solchen Wassers an organischer Materie gestattet.

In 1 cbcm Spreewasser in der Stadt Berlin oberhalb der Panke befanden sich . .	940 000	entwickelungsf.	Keime
in 1 cbcm Spreewasser in der Stadt Berlin unterhalb der Panke befanden sich . .	1 800 000	„	„
in 1 cbcm Spreewasser bei Bellevue . .	4 480 000	„	„
in 1 cbcm Spreewasser bei Charlottenburg	10 180 000	„	„
in 1 cbcm Wasserleitungswasser im Gesundheitsamte (Tegler Leitung)	160—205	„	„
in 1 cbcm Wasser aus dem Tegler See	3 740	„	„
in 1 cbcm Brunnenwasser aus verschiedenen Berliner Brunnen	40—160*	„	„
in 1 cbcm Wasserleitungswasser aus den Stralauer Wasserwerken, unfiltrirt . .	125 000**	„	„
in 1 cbcm desgl., filtrirt	120***	„	„
in 1 cbcm Spüljauche aus dem Druckrohr in Falkenberg, unfiltrirt (Canalisation)	38·000·000†	„	„

Nach einem Vortrage Koch's auf dem deutschen Aerztetage (Fortschr. d. Med. Heft 13) können wir diese Angaben noch dahin ergänzen, dass man statt

*) In einigen Fällen 4 000 und 12 000.
**) Darunter 125 Gelatine verflüssigende.
***) Darunter 5 Gelatine verflüssigende.
†) Darunter 980 000 die Gelatine verflüssigende.

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eines Tropfen Wassers von vorher bestimmter Grösse ein bestimmtes Quantum desselben mit einer bestimmten Menge der Nährgelatine in einem sterilisirten (auf 150° C. erhitzten) Kölbchen vermischt und das Gemisch auf sterilisirte Glasplatten ausgiesst. Manche Bacterienarten entwickeln Gase, so dass die Gelatine von Gasblasen durchsetzt erscheint, welche über der Colonie sich befinden, von der sie erzeugt sind. In dem auf der Hygieneausstellung befindlichen Pavillon des Reichs-Gesundheitsamtes befanden sich die für die bacterioskopische Wasseruntersuchung in Anwendung gebrachten Apparate, ebenso einige darauf bezügliche Präparate. Colorirte Karten zeigten die von den entwickelungsfähigen Keimen des Wassers auf Gelatine erzeugten Bacterien-Colonien.

J. Brautlecht (Rep. d. anal. Chem. **3**, 106) verfährt bei der mikroskopischen Untersuchung des Wassers in der Weise, dass er 50—100 cbcm davon mit 5 Tropfen einer Lösung, bestehend aus 1 Tl. Aluminiumsulfat, 1 Tl. Salzsäure und 8 Tl. Wasser, und dann mit soviel Ammoniak versetzt, dass ein mässiger Niederschlag entsteht, den man abgiesst und in Essigsäure löst. In dieser Lösung befinden sich die Mikroorganismen. — J. v. Fodor (Hyg. Unters. über Luft, Boden und Wasser. Braunschweig 1882. Bd. 2, 316) setzt zum Wasser Hausenblaselösung hinzu und untersucht nach einigen Tagen mikroskopisch. — Harz (Dingl. pol. Journ. **248**, 38) schlägt vor, eine gut gereinigte Flasche bis auf $^1/_3$ ihres Inhaltes mit dem Wasser zu füllen, gut verschlossen an einem hellen Platz stehen zu lassen und dann zu untersuchen. Je nach der Jahreszeit und der Beschaffenheit der vorhandenen Organismen bilden sich nach einigen Tagen an den Wänden des Gefässes Ansätze von grüner, rötlicher oder brauner Farbe. — F. Veidowski (Tier. Organismen der Brunnenwasser von Prag, 1882 und Dingl. pol. Journ. **248**, 38) hält diese Methode nicht für geeignet, da man nur die Organismen auffindet, die im Wasser selbst vorhanden sind, nicht aber die am Boden und den Wänden des Brunnens vorkommenden. Er giebt eine Vorrichtung zum Sammeln derselben an. Die bei der Untersuchung von etwa 200 Prager Brunnen gefundenen Organismen beschreibt Verfasser genauer. — L. Maggi (Gazz. Chim. **13**, 323) versetzt behufs Erkennung der Mikroorganismen im Trinkwasser dasselbe mit einer Palladiumchloridlösung (1 : 800). Im entstandenen Niederschlag kann man die Bacterienformen sehr deutlich erkennen und von einander unterscheiden. — Zur mikrographischen Untersuchung eines Wassers setzt man nach Vassal 1 cbcm einer 1proc. wässrigen Lösung von Osmiumsäure zu 30—40 cbcm des zu untersuchenden Wassers. Die Organismen werden dadurch getödtet, ohne ihre Gestalt zu verändern. Nach einiger Zeit wird die Flüssigkeit vorsichtig abgegossen und der Absatz bei 700—800facher Vergrösserung mikroskopisch geprüft. (Arch. Pharm. 21, 450.)

Bestimmung der organischen Substanzen im Trinkwasser von J. W. Mallet (Chem. News **46**, 63; Ber. Chem. Ges. **15**, 2930 und **16**, 1242). Behufs Vergleichs der verschiedenen Bestimmungsmethoden wurden

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vom Verfasser Proben verschiedener Wasser einer Anzahl von Chemikern zugleich zur Untersuchung gegeben. Auf Grund der erhaltenen Resultate werden die Fehler der einzelnen Verfahren discutirt. Bei der Verbrennungsmethode von Frankland und Armstrong fällt die Kohlenstoffbestimmung zu niedrig, der organische Stickstoff zu hoch aus. Jedoch ist die Methode genauer, als die Permanganat-Methode und die Zahlen für den organischen Stickstoff sind besser verwertbar, als die nach dem Wanklyn'schen Verfahren erhaltenen. Die Methode von Wanklyn, Chapmann und Smith giebt den „freien" und „Albuminoid - Stickstoff" zu niedrig an. Die Permanganat - Methode von Kubel giebt in der Regel höhere Zahlen als die von Tidy. In keinem Falle braucht man die Menge Chamaeleon, die zur vollständigen Oxydation der organischen Stoffe nötig sein müsste. Der erste Teil des Berichtes bespricht, gestützt auf die mit denselben Wässern angestellten mikroskopischen und physiologischen Versuche, die Zulässigkeit von Schlüssen aus den analytischen Daten und die Brauchbarkeit eines Wassers als Trinkwasser. Verfasser beschreibt einen Apparat, in dem sich Wasser bei starker Evacuirung des Destillationsgefässes und unter Ausschluss der Berührung mit der Luft für den Verbrennungsprocess eindampfen lässt, so dass die Verdunstung nur wenig über 30° stattfindet. Zur Austreibung des praeexistirenden Ammoniaks wird man während des Eindunstens Magnesia nicht anwenden (vgl. Lechartier, Ber. Chem. Ges. **12**, 2160), da sie nach des Verfassers Versuchen schon bei 40—50° Ammoniak aus gewissen stickstoffhaltigen Substanzen (Harnstoff) freimacht. Zur Reduction und Entfernung der Nitrate empfiehlt sich die unterphosphorige Säure, womit man das Wasser eindampft; der Rückstand wird zur Neutralisation mit Magnesia, dann mit reiner Kieselsäure versetzt, und nach dem Eintrocknen der Kohlenstoff und Stickstoff darin durch Verbrennung bestimmt. Bezüglich der Albumnoid - Ammoniakbestimmung teilt Verfasser einige Versuche von Ch. Smart mit, welche die Austreibung geringer Mengen Ammoniaks aus Wasser und die Absorption der ausgetriebenen Base unter verschiedenen Bedingungen (Temperatur, Druck, Zeitdauer) behandeln. Schliesslich zeigt Mallet, dass, wenn man bei der Chamaeleonprobe dafür sorgt, dass das Oxydationsmittel stets im Ueberschuss bei seiner Einwirkung vorhanden ist, etwas höhere Resultate erzielt werden; auch scheint die Einwirkung regelmässiger zu verlaufen. — Ekmann kritisirt die Chamaeleonmethode. (Ber. Chem. Ges. **16**, 1242.) Es ist vorteilhafter in alkalischer, als in saurer Lösung zu oxydiren. Jedoch entstehen in ersterem Falle Producte, die erst in saurer Lösung von Chamaeleon vollständig oxydirt werden. Um daher eine möglichst vollständige Oxydation zu erhalten, schlägt Verfasser vor, erst in alkalischer, dann in saurer Lösung mit einem grossen Ueberschusse von Chamaeleon zu kochen und dann wie gewöhnlich zu verfahren. — Leroy Mac Cay (Chem. News **47**, 195) misst bei Anwendung des Tidy'schen Verfahrens zur Bestimmung der organischen Substanzen im Wasser den Ueberschuss von Permanganat nicht durch Jodkalium und Natriumhyposulfit, sondern durch Eisenammonsulfat zurück. — Ueber eine photochemische

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Methode der Bestimmung organischer Stoffe im Trinkwasser schreibt Albert R. Leeds (Phil. Mag. 1883, 9). Reines Wasser scheidet aus einer Silbernitratlösung kein Silber ab, wenn die Lösung 48 Stunden lang dem Sonnenlicht ausgesetzt wird. Dagegen tritt Abscheidung von Silber ein, sobald das Wasser organische Stoffe enthält. 200 cbcm Wasser werden mit 10 cbcm $^1/_{10}$ Norm. Höllensteinlösung versetzt und in wohlverschlossenen hohen Cylindern etwa 2 Tage lang stehen gelassen. Der während dieser Zeit sich bildende Niederschlag wird zur Entfernung des Chlorsilbers mit Ammoniak versetzt und das zurückbleibende metallische Silber bestimmt. Unter der Annahme, dass 108 Tle. Silber 16 Tln. Sauerstoff entsprechen, wird aus der gefundenen Silbermenge der verbrauchte Sauerstoff berechnet und mit dem bei der Oxydation der organischen Materie mittels Chamaeleon verbrauchten Sauerstoff verglichen. Bei diesem Vergleich weichen die Zahlen indess bedeutend von einander ab.

Einen Apparat zur Bestimmung des Ammoniaks im Trinkwasser giebt C. R. Tichborne (Chem. News **46**, 247) an. Um das Destillat vor der Berührung mit Laboratoriumsluft und Flammengasen zu schützen, wird die Retorte mit einer Vorlage und diese mit zwei Kugelröhren, die U förmig gebogen sind und an der mittleren Kugel ein Abflussrohr mit Hahn tragen, luftdicht verbunden. Durch das Hahnrohr werden die Kugelröhren mit ammoniakfreiem destillirtem Wasser gefüllt. Das Ammoniak condensirt sich zum grössten Teil in der Vorlage und in dem ersten Kugelrohr, während das zweite Kugelrohr als Verschluss gegen die Luft dient. Der Inhalt von der ersten Röhre wird mit demjenigen der Vorlage gemischt und dann titrirt. — Charles W. Marsh (Amer. Chem. Journ. **4**, 188) hat constatirt, dass die Summe von freiem Ammoniak (durch Destillation bestimmt) und Albuminoid-Ammoniak stets kleiner gefunden wird, als das Gesamt-Ammoniak (durch Zusatz von Permanganat abtreibbar).

Nach Bouchardat, Famé und Kämmerer kann man Tannin zur Erkennung gewisser organischer Substanzen anwenden. Nach Jorissen (Journ. Pharm. d'Anvers; Pharm. Centrh. **24**, 101) giebt nun ein destillirtes Wasser, dem auf 300 cbcm einige Tropfen einer Chlorcalciumlösung zugesetzt wurden, mit Tannin keinen Niederschlag, bei Gegenwart von Ammoniak aber eine starke Trübung; letztere ist in einem Ueberschuss des Reagens, in verdünnten Säuren, selbst in Kohlensäure löslich. Selbst wenn die Ammoniakmengen so gering sind, dass das Wasser weder auf Sublimat noch auf Lakmuspapier reagirt, erhält man bei Gegenwart von Kalksalzen durch Tannin einen Niederschlag. Vermöge dieser Empfindlichkeit lässt sich die Reaction zur Erkennung von freien und kohlensauren Alkalien und besonders von Ammoniak anwenden, vorausgesetzt, dass nicht andere Körper in der Flüssigkeit sind, die mit Tannin oder Kalksalzen in verdünnter Lösung einen Niederschlag geben. Zu diesem Nachweise dient eine Mischung gleicher Volumina einer alkoholischen Tanninlösung (1 : 10) und einer wässrigen Chlorcalciumlösung (ebenfalls 1 : 10).

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Edmund W. Davy (Chem. News **46**, 1) publicirt eine Methode zur Bestimmung der Nitrite. Die salpetrige Säure bezw. Nitrite liefern unter Gasentwickelung mit Gallussäure eine gelbliche, nach und nach braun werdende Färbung; besonders schnell tritt die Reaction beim Kochen ein. Verdünnte Mineralsäuren sind ohne Einfluss auf die Färbung. Zur colorimetrischen Bestimmung der salpetrigen Säure nimmt man eine gesättigte Gallussäurelösung, die durch Tierkohle entfärbt ist und durch Zusatz von verdünnter Schwefelsäure oder Salzsäure farblos erhalten werden kann. Die Normal-Nitritlösung enthält in 1 cbcm 0·01 oder 0·02 mg N^2O^3. Nitrate geben die Reaction mit Gallussäure nicht. Eisensalze werden vor der Bestimmung durch Ammoniak entfernt. Nach Verf. ist durch Gallussäure 1 Teil N^2O^3 in 20 Millionen Teilen Wasser noch nachweisbar. — Ch. Ekin (Journ. Pharm. d'Alsace-Lorraine; Pharm. Centrlh. **23**, 399) verglich die Empfindlichkeit der Metaphenylendiamin- und Naphtylamin-Reaction auf salpetrige Säure mit der des Jodkaliumstärkekleisters und fand, dass die letztere den beiden ersteren Reagentien nicht nachsteht.

J. Boyd Kinnear (Chem. News **46**, 33) hat bei der Bestimmung der Salpetersäure durch Ueberführung derselben in Ammoniak mittels Zink und Schwefelsäure befriedigende Resultate erhalten, sobald die Lösung der Nitrate so verdünnt war, dass 1 Teil Stickstoff in 5000 Teilen Wasser sich gelöst befand. Bei Abwesenheit von Eisen und anderen Substanzen, die gefärbte Jodide bilden, kann das Ammoniak durch Nessler's Reagens direct bestimmt werden. Organische stickstoffhaltige Substanzen sind ohne Einfluss auf das Resultat.

Ueber eine abgeänderte Methode der Hydrotimetrie berichtet L. Garnier (Journ. Pharm. Chim. [5] **7**, 482; Chem. Centralbl. [3] **14**, 570). Die Seifenlösung hält sich bekanntlich nicht, sondern scheidet bald mehr, bald weniger Seife ab. Um eine solche Flüssigkeit, nachdem sie filtrirt ist, wieder gebrauchen zu können, verfährt Verf. folgendermaassen: Zunächst sei erwähnt, dass 40 cbcm der Chlorcalciumlösung (von 0·25 Proc.) oder der Baryumnitratlösung (0·5878 g im Liter) bis zum Erscheinen eines dauernden Schaumes 2·4 cbcm Normal-Seifenlösung verlangen, entsprechend 22 hydrotimetrischen Graden. Diese erhöhen sich auf 23°. wegen des Ueberschusses, der nötig ist, um mit 40 cbcm destillirtem Wasser einen dauernden Schaum zu erzeugen. Angenommen, dass von der veränderten filtrirten Seifenlösung 27° (also 28°) nötig sind, um 40 cbcm titrirte Baryumnitratlösung zu fällen und dass 16° (also 17°) derselben Lösung in 40 cbcm des zu untersuchenden Wassers den charakteristischen Schaum erzeugen, so ergiebt sich folgende Rechnung: 28° der veränderten Lösung entsprechen 23° der Normal-Seifenlösung, mithin $17° = \frac{23 \times 17}{28} = 14·3°$. Die 40 cbcm Wasser würden also 14·3° Normal-Seifenlösung verlangen, oder wenn man die zur Erzeugung des Schaumes nötige Menge abzieht: 13·3°. — Diese Modification gestattet, jede veränderte Seifenlösung zu benutzen, voraus-

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gesetzt, dass sie klar ist. Man prüft dieselbe zuvor mit der normalen Baryumnitratlösung und erhält mit Hülfe der Formel: $x = \frac{23\ (n + 1)}{N + 1} - 1$ die Härte. N sind die für 40 cbcm Barytlösung verbrauchten Grade und n die bei der Prüfung verbrauchten Grade. — Eine Bestimmung der Härte des Wassers ohne Seifenlösung hat Otto Hehner (Analyst 8, 77) ausgearbeitet, welche eine Erweiterung der Mohr'schen Methode darstellt. Als Normallösung dienen Schwefelsäure, die im Liter 0·98 g H^2SO^4 enthält, und Natriumcarbonat (frisch geglüht) 1·06 g im Liter. 1 cbcm dieser Lösungen neutralisirt bezw. fällt 0·001 g Calciumcarbonat. 100 cbcm des zu untersuchenden Wasser werden nach dem Zusatz von Phenacetolin, Methylorange oder Cochenille zum Sieden erhitzt und mit der obigen Schwefelsäure neutralisirt. Jedes Cubik-Centimeter zeigt 1° temporäre Härte an. Weitere 100 cbcm des Wassers werden mit der überschüssig zugesetzten Normal-Natriumcarbonatlösung in einer Platinschale zur Trockne verdampft, der Rückstand mit Wasser ausgelaugt und das Filtrat mit der Säure titrirt. Die Cubik-Centimeter Alkalicarbonat minus Säure zeigen die permanente Härte, in ihrem Äequivalente an Calciumcarbonat ausgedrückt, an.

Tichborne (Chem. News **46**, 235) empfiehlt folgendes Verfahren der Bereitung einer Maassflüssigkeit zur Härtebestimmung des Wassers. Eine alkoholische Oelsäurelösung wird mit einigen Tropfen Phenolphtalein und mit so viel Normal-Natronlösung versetzt, bis eine rötliche Färbung auftritt. 4·575 g Oelsäure verlangen 0·62 g NaHO oder 15 cbcm Normal-Natronlauge. Die so erhaltene Seife wird mit gleichen Volumen Alkohol und Wasser auf 820 cbcm verdünnt und entspricht sodann der ursprünglichen von Clarke angegebenen Lösung. Verwendet man für Herstellung der Seifenlösung nur Wasser, so bildet sich gallertartiges Natriumoleat, das Phenolphtalein nicht rötet. — Aug. Houzeau (Compt. rend. **95**, 1064) teilt eine volumetrische Bestimmung der alkalischen Erdbicarbonate im Wasser bei Abwesenheit der kohlensauren Alkalien mit. Zur Bestimmung des Calcium- und Magnesiumcarbonats setzt man zu 100 cbcm Wasser, wenn dasselbe kein Calciumsulfat enthält, 1 cbcm Cochenillelösung und so lange von einer Normal-Oxalsäure (4 cbcm = 10 mg CO^2 oder 28 mg $C^2H^2O^4 + 2$ aq) hinzu, bis die Flüssigkeit bleibend gelb geworden ist, filtrirt den Niederschag und titrirt denselben mit Chamaeleonlösung (1 cbcm = 1·6 mg $KMnO^4$). Die verbrauchte Chamaeleonmenge entspricht dem Kalkgehalt, die Quantität der Oxalsäurelösung der Menge von Kalk- und Magnesiabicarbonat; die Differenz entspricht der Magnesia.

6. Künstliche Mineralwässer.

C. Mönch (Correspondenzbl. d. Ver. Deutscher Mineralwasser-Fabrikanten **1**, 13) hat zur Kohlensäureentwickelung mit Vorteil Arragonit an Stelle von Magnesit angewendet.

Eingehende Versuche über die Verwendung flüssiger Kohlen-

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säure zur Mineralwasserfabrikation sind von Volk in Ratzeburg (l. c. **1**, 65) angestellt worden. Derselbe erklärt die Methode des Imprägnirens von Mineralwasser mit Hilfe flüssiger Kohlensäure für die reinlichste, bequemste und beste, die es giebt. Ein kg flüssiger Kohlensäure (von Kunheim & Co. in Berlin) kostet 2 *M.*, entspricht ca. 500 l gasförmiger CO^2, wird in Behältern zu 8 kg verschickt, die das Eigengewicht von 37 kg haben. Die Behälter im Werte von 80 *M* das Stück werden leihweise von der Fabrik abgegeben. Der Preis des Gases aus flüssiger Säure stellt sich ohne Fracht ca. 3 mal so hoch, als für das selbst dargestellte, enthält dagegen in dieser Form eine sehr bedeutende mechanische Arbeit aufgespeichert, die bei der Verwendung in der Mineralwasser-Fabrikation gespart werden kann.

Zur Bestimmung der Kohlensäure im Sodawasser verfährt Fr. Stolba (Listy. Chem. **6**, 279 Chem. Centralbl. **13**, 824) in der Weise, dass der Stöpsel der tarirten Flasche mittelst eines hohlen, mit einem Hahne versehenen Cylinders angebohrt und die entweichende Kohlensäure langsam durch einen Trockenapparat ins Sammelgefäss geleitet wird. Die letzten Gasspuren werden durch Einstellen der Flasche in ein auf 70—80° C. erwärmtes Wasserbad und durch Saugen entfernt. Die Kohlensäure wird in einer gewogenen, mit Natronkalk beschickten Glasröhre absorbirt. In einem Teile des übriggebliebenen Wassers werden durch Titriren die Carbonate bestimmt; in einem zweiten Teile wird die gesamte noch darin enthaltene Kohlensäure entweder durch Fällen mit Barytwasser oder besser in der Weise ermittelt, dass die Kohlensäure durch Zusatz von conc. Schwefelsäure und längeres Kochen, sowie Durchleiten von Luft ausgetrieben, getrocknet und mittels Natronkalk absorbirt wird.

Ueber das Verhalten zinkhaltiger Eisenglasur gegen kohlensaure Mineralwässer hat H. Fleck (X. u. XI. Jahresb. d. K. Chem. Centralstelle f. öffentl. Gesundheitspfl. in Dresden, S. 62) Versuche angestellt. Die Glasur bestand aus Kiesel- u. Phosphorsäure, Kalk-, Zinn- und Zinkoxyd. Wasser eines Eisensäuerlings löste daraus Zink auf und befand sich 1 Tl. Zink in 43·75 Tln. dieses Mineralwassers.

E. Harnack (Berl. Klin. Wochenschr. 1882, Nr. 19) giebt auf Grund seiner Analyse des nach dem neuen Verfahren hergestellten Karlsbader Salzes (36·19 $NaHCO^3$, 17·24 NaCl, 46·09 Na^2SO^4) für die Herstellung des künstlichen Salzes folgende Vorschrift: 100 $NaHSO^4$, 80 $NaHCO^3$, 40 NaCl. Für die Pharm. Germ. Ed. II ist als Sal Carolin. factit. eine Mischung acceptirt worden aus 44 $NaHSO^4$, 36 $NaHCO^3$, 18 NaCl, 2 K^2SO^4. 6 g dieses Pulvers in 1 l Wasser gelöst geben ein dem Karlsbader Brunnen ähnliches Wasser. — Einer Analyse E. Geissler's zufolge (Pharm. Centralbl. **24**, 96) besteht das jetzt in den Handel gelangende Karlsbader Salz aus 33·90 $NaHCO^3$ (+ Li), 1·07 Na^2CO^3, 43·64 Na^2SO^4, 3·18 K^2SO^4, 17·94 NaCl.

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7. Abflusswässer.

Ueber Reinigung von fauligem Abflusswasser aller Art durch Zuführung von Luft beim Herabrieseln an einem Drahtnetz schreibt J. Koenig (Landw. Jahrb. 1883; Chem. Centralbl. [3] **14**, 174). Die Uebelstände der Abflusswässer werden hervorgerufen: 1. durch einen hohen Gehalt des Wassers an suspendirten organischen Stoffen oder Schlammteilchen aller Art, wozu bei den Färberei-Abflusswässern noch Farbstoff hinzutritt; 2. durch übelriechende Fäulnisproducte (Schwefelwasserstoff, Schwefel- oder sonstige reducirte Verbindungen und Stoffe von unvollendeter Oxydationsstufe); 3. durch Mangel oder vollständiges Fehlen von Sauerstoff. — Die Art und Weise der Reinigung wird sich ganz nach den localen Verhältnissen richten müssen. Am weitesten verbreitet sind folgende, auch durchaus als rationell zu bezeichnende Methoden: 1. Zur Entfernung der suspendirten organischen Stoffe lässt man die Abflusswässer eine Reihe Klärteiche passiren; es tritt Fäulnis ein, wobei durch die entwickelte Kohlensäure die Schlammteilchen teils an die Oberfläche geworfen werden, so dass sie abgeschöpft werden können, teils aber zu Boden sinken. Um den letzteren Process zu beschleunigen, setzt man je nach der Beschaffenheit des Wassers chemische Fällungsmittel zu, z. B. Kalkmilch oder Wasser, so dass das sich bildende Calciumcarbonat die organischen Schlammteile mit niederreisst. Der entstehende kalkreiche Schlamm giebt einen guten Dünger ab. 2. Ein Teil dieser Abflusswässer wird entweder direct oder nach vorheriger Reinigung in Klärteichen zur Berieselung von Wiesen benutzt. 3. In anderen Fällen lässt man das faulige Wasser an Gradirwerken herunterrieseln oder filtrirt es durch eine passende, unten mit Abflussdrainröhren versehene Filtrirschicht von Coks, Sand etc. — Das Wesen aller dieser Reinigungsmethoden besteht darin, einmal die suspendirten organischen Schlammteile aus den Wässern zu entfernen, dann den letzteren Luft bezw. Sauerstoff zuzuführen und zwar a) zur Oxydation der Fäulnisstoffe, b) um dasselbe wieder mit Sauerstoff als solchem zu sättigen.

Das Hauptaugenmerk muss bei allen Reinigungsvorrichtungen darauf gerichtet werden, dass das Wasser wieder vollständig mit Sauerstoff gesättigt wird. Die beste derartige Reinigungsvorrichtung ist die, solche Wässer über Wiesen zu leiten. Es ist alsdann mit der Reinigung des Wassers gleichzeitig noch eine Düngung der Wiesen verbunden. Die Benutzung der Abflusswässer zur Wiesenberieselung hat aber ihre Grenzen. Eine Klärung des Wassers in Klärteichen und nachfolgende Filtration reicht nicht aus, es muss die Luftsättigung hinzutreten. Als unpraktisch hat sich erwiesen, in das betreffende Wasser Luft einzuleiten oder einzupressen. Dagegen empfiehlt es sich, das Wasser in äusserst feinem Strale oder dünner Schicht an der Luft auszubreiten, z. B. in Gradirwerken; jedoch sind deren Anlagekosten zu bedeutend. Verf. hat daher Versuche über die Reinigung derartiger Abflusswässer durch Herabrieseln an einem Drahtnetze angestellt. Hierbei findet eine sehr grosse Aus-

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breitung des Wassers und lebhafte Oxydation der fauligen Stoffe statt. — Was die praktische Verwendung vorstehenden Verfahrens anbelangt, so ist zu bemerken, dass ein an organischen Schlammstoffen reiches Wasser vorher in Klärteichen gereinigt werden muss. Enthält ein Wasser nur geringe Mengen suspendirter organischer Substanz, so kann es direct zur Lüftung benutzt werden, andererseits lässt sich leicht oben am Drahtnetze ein trichterförmiger Aufsatz anbringen, der mit feinen den Maschen entsprechenden Löchern versehen ist und mit einer zweckmässigen Filtrirmasse (Coks, Sand, Holzkohle) gefüllt wird. Die Höhe des anzuwendenden Drahtnetzes richtet sich ganz nach der Beschaffenheit des Abflusswassers; bei einem Gehalte von 20 mg Schwefelwasserstoff pro Liter genügt eine Höhe von 4—5 m. Die Breite des anzuwendenden Drahtgeflechtes, welches zwischen Holz- und Eisenständern aufgespannt wird, ist abhängig von der Menge des Abflusswassers. An einem Drahtnetze von 50 cm Breite können 6—7 l pro Minute herabrieseln, um die erwähnten Wirkungen zu erzielen.

A. Anthony Nesbit (Chem. News. **46**, 43) führt den Nachweis von Chlorkalk im Wasser, das aus Papierfabriken und Bleichereien abfliesst, durch eine Lösung von 100 g Kaliumjodid in 16 Unzen Wasser, die mit 100 g Stärke und 1 Unze kaltem Wasser gemischt 30 Minuten im Sieden erhalten wird. Man muss das Reagens sofort benutzen. Von dem zu untersuchenden Wasser bringt man etwas in ein auf weissem Papier stehendes Becherglas und lässt aus einer Bürette die Stärkelösung einfliessen.

In der Hygiene-Ausstellung war eine grosse Anzahl von Zeichnungen, Modellen, Broschüren etc. betreffend die Unschädlich- und Nutzbarmachung von Fabrik-Abwässern und -Abfällen zur Ansicht vorhanden. Wir bringen zur Information nur eine kurze Zusammenstellung dieser Objecte, zum Teil entnommen dem Katalog der Collectiv-Ausstellung des Königlich Preussischen Ministeriums für Handel und Gewerbe.

Knauer's Verfahren zur Reinigung der Abwässer von Zuckerfabriken, Brennereien, Brauereien, Stärkefabriken etc. (D. P. 6211 und 9791.)*)

Einrichtungen zur Reinigung der Abwässer in der Zuckerfabrik in Lützen. (Vom Gewerberat in Merseburg ausgestellt).

Reinigung der Abwässer in der Zuckerfabrik zu Poln. Peterwitz. (Von Dr. E. Webesky in Wüstewaltersdorf in Schlesien ausgestellt.)

Behandlung der Abwässer in der Zuckerfabrik zu Klettendorf. (Gebr. Schöller, Breslau, Aussteller.)

Vernichtung der schädlichen Teer- und sonstigen Fabrik-Abwässer der Werschen-Weissenfelser Braunkohlen-Actien-Gesellschaft Köppen.

Apparat zur Gewinnung des Ammoniaks aus Gaswasser für kleinere Gasanstalten von Vorster & Grüneberg in Kalk.

Apparat zur continuirlichen Destillation ammoniakhaltiger Abwässer von Gasanstalten in der Stadt Bielefeld. (D. P. 21708 von Feldmann.)

*) Techn.-chem. Jahrb. 1882, S. 317; 1883 S. 268.

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Unschädlich- und Nutzbarmachung der Abwässer der Drahtziehereien (Gewinnung von Eisenvitriol), Aussteller G. Reinhard in Schwel.

Reinigung von Papierfabrik-Abwässern (wiedergewonnener Papierstoff daraus) von G. F. Halbrock in Hillegossen b. Bielefeld (Schuricht's Pat.*).

Schwamborn'sches Verfahren zur Unschädlich- und Nutzbarmachung der Abwässer von Tuchfabriken und Walkereien, ausgestellt von der technischen Hochschule in Aachen.

Maassnahmen zur Unschädlichmachung der Abwässer und Abfälle der Kürschnereien in der Stadt Lissa.

Benutzung der Fabrikabwässer zum Betriebe von Fahrstühlen und für Feuerlösch-Einrichtungen. Aussteller Stettiner Portland-Cementfabrik Züllchow bei Stettin, und schliesslich

Polizei-Verordnung betreffend die Unschädlichmachung der beim Betriebe der Teerschwelereien und Mineralöl-Fabriken sich ergebenden Abwässer. Regierungspräsidium Merseburg.

In der Spindler'schen Färbe- und Waschanstalt zu Spindlersfeld bei Berlin werden das verbrauchte Wasser der Färberei, die unbrauchbar gewordenen Farbebäder, die Excremente und das Spülwasser der Closets in Bassins geleitet, wo die festen Bestandteile zum Teil zu Boden fallen. Die Flüssigkeit wird unter Zusatz von Chemikalien in Absatz- und Filtrirbassins durch Centrifugalpumpen gedrückt. Das hierbei erhaltene bereits klare Wasser dient teils zum Bewässern der Bäume, ein anderer Teil davon wird den Rieselanlagen zugeführt. Die aus den Absatzbassins erhaltenen Rückstände, die zum grösseren Teil aus Fetten, Gerbstoffen und Eisenverbindungen bestehen, werden vergast. 100 kg liefern in 2—4stündigen Chargen 15—16 cbm Leuchtgas. (Hygiene-Ausstellung; Katalog der Spindler'schen Fabrik, S. 39.)

Eisbereitung und Kälteerzeugung.

Paul Lohmann (Corresp.-Bl. d. Ver. Miner. Wasserfabr. **1**, 102) beschreibt zwei Systeme zur Herstellung des künstlichen Eises. Die Carré'sche Eismaschine in der Construktion Vaas und Littmann in Halle a. S. und die Vacuum-Eismaschine von Otto Henniges & Co. in Berlin-Moabit, welche auch in der Hygiene-Ausstellung in Betrieb waren.

Die Eismaschine von W. M. Wood und W. L. Bailie (Amer. Pat. 283054; Chem. Ztg. **7**, 1142) besteht aus einer Compressionspumpe und zwei stehenden Cylindern, in denen je eine enggewundene Rohrspiralesteht. In dem einen Cylinder wird Ammoniak verdampft, die Dämpfe werden in die Pumpe verdichtet und im Rohre des andern Cylinders condensirt. Die Flüssigkeit fliesst dann in den ersten Cylinder zurück. — John Chester de la Vergne und W. M. Mixer in New-York (D. P. 17336) treffen die Anordnung, dass die Compressionscylinder *J* auf gusseisernen Böcken ruhen, zwischen welche

*) Techn.-chem. Jahrb. 1883, S. 359.

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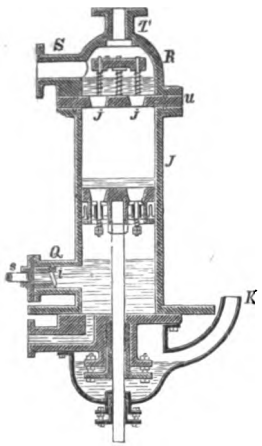
Fig. 275.

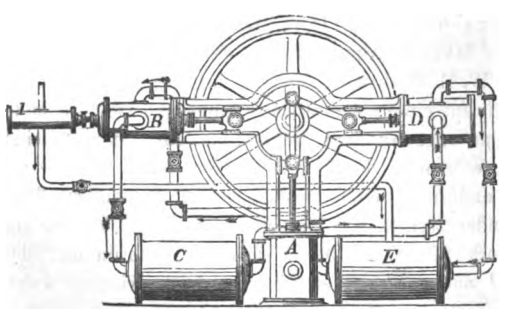


quer hindurch die von der Dampfmaschine getriebene Welle läuft. Zum Abschliessen der Aussenseite jener Pumpencylinder *J*, sowie zum Oelen der Kolbenstange wird durch das Röhrchen *K* die ölende Flüssigkeit zugeführt. Der Zufluss zum Pumpeninneren selbst geschieht durch den Stutzen, welcher mit einer Plungerpumpe verbunden ist. An demselben Ende befindet sich ein weiterer Ansatz *Q*, an welchem das Gassaugerohr *s* befestigt ist, und welcher mit einem Klappenventil *i*, nach innen zu öffnen, versehen ist. Die Kuppel *R* besitzt zwei Ausgangsöffnungen *S* und *T*, wovon erstere mit dem Flüssigkeitsabflussrohr und *T* mit dem Gasdruckrohr verbunden ist. *u* ist eine Zwischenplatte, mit Ventilen *jj* versehen, welche die beiden Räume der Pumpe für den Durchgang der comprimirten Gase und ölenden Flüssigkeit verbinden.

Nach Osenbrück in Hemelingen (D. P. 18670) soll der bei den doppeltwirkenden Gaspumpen unvermeidliche Gasverlust, welcher dadurch eintritt, dass die Kolbenstangen abwechselnd mit den Gasen und der Luft in Berührung kommen und adhärirendes Gas nach aussen führen, vermieden werden. Es ist eine mit den Pumpencylindern communicirende Kammer angeordnet, in der die Antriebsmechanismen für die Pumpenkolben befindlich sind. Diese Kammer und ein Teil des darüberliegenden Druckkessels ist mit Schmieröl gefüllt, welches dem Gase den Eintritt in die Kammer verwehrt. Das Schmieröl steht unter dem Maximaldruck des comprimirten Gases. Beschreibung der Ammoniak-Compressions-Kälteerzeugungsmaschine, Osenbrück, in Allg. Br.- u. Hopfenztg. **28**, Nr. 56, 57 und 59.

Bei der Luftexpansionsmaschine von Leicester Allen in New-York findet die Verdichtung und darauffolgende Ausdehnung der Luft oder des Gases bei Spannungen statt, die bedeutend höher als der atmosphärische Druck sind. Bei ihrer Compression und Expansion macht die Luft oder das Gas einen beständigen Kreislauf, indem sie im Cylinder *B* comprimirt, in *C* abgekühlt und im Cylinder *D* expandirt wird. Von *D* strömt die Luft in den Kälteerzeugungscylinder *E*, aus welchem sie wiederum in den

Fig. 276.



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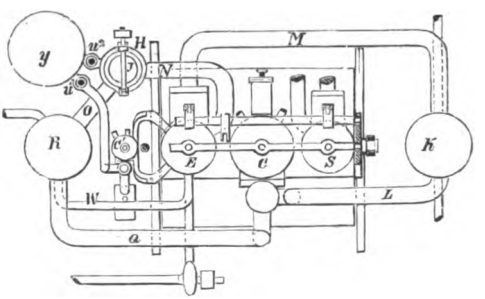
ursprünglichen Luftverdichter *B* gelangt, um den Kreislauf von neuem zu beginnen. Zur Ersetzung der Luft- oder Gasverluste dient die Hilfspumpe *I*. Den Betrieb des Mechanismus vermittelt die Dampfmaschine *A*. (D. P. 20227.)

Die Wirkungsweise der Hochdruck-Kaltluftmaschine von Windhausen in Berlin und Haurie in London (D. P. 18353) beruht auf dem Princip der Kälteerzeugung durch Compression, Abkühlung und nachherige Expansion von Luft. In einem Compressionscylinder, welcher aus zwei conaxial über einander angeordneten Cylindern verschiedenen Durchmessers besteht, deren Kolben durch eine gemeinsame Kolbenstange starr mit einander und durch eine Lenkerstange mit der T-förmigen Pleuelstange verbunden sind, wird atmosphärische Luft angesaugt, daselbst bis auf hohen Druck comprimirt, dann in einen Kühlapparat ausgeworfen und abgekühlt, indem sie unten tangential eintretend, durch einen Blechring nach den von Kühlwasser umgebenen Kühlröhren eines cylindrischen Behälters strömt. Darauf durchströmt sie die Kühlröhren eines zweiten Kühlbehälters von oben nach unten. An den Ein- und Austritten der Kühlapparate befinden sich Einrichtungen zur Abführung des Condensationswassers, welches durch Badeschwämme aufgenommen wird. Das Kühlwasser strömt der Luft entgegengesetzt durch die beiden Kühlapparate und von da in den Wasserraum um den Compressionscylinder. Die so abgekühlte und entwässerte comprimirte Luft gelangt nunmehr in den Expansionscylinder. Dieser ist nahezu von gleicher Construction wie der Compressionscylinder. Die comprimirte Luft wirkt in demselben wie der Dampf in einer Woolf'schen Expansionsdampfmaschine, durch Drehschieber gesteuert. Im Expansionscylinder expandirt die Luft bis auf Atmosphärenspannung, wird dementsprechend abgekühlt und dann ausgeworfen.

Bei der Maschine von Klein in New-York (D. P. 19065) liefert der Dampfcylinder *S* die Betriebskraft. Von den Absperrventilen U^1 U^2 wird das erstere geöffnet und das letztere geschlossen. Der kleine Luftcompressor C^1 (die Luftspeisevorrichtung) füllt zunächst das Reservoir *y* mit comprimirter Luft, bis die Spannung in *y* um einen bestimmten Betrag höher ist, als die gewünschte Minimalspannung der Arbeitsluft; alsdann wird das Absperrventil u^2 allmälig geöffnet, die Speiseluft steigt langsam in Rohr H^1 in die Höhe (Fig. 278), während die Feuchtigkeit sich niederschlägt und in H^2 ansammelt. Die trockene Speiseluft tritt bei *x x* in den Kreislauf der Arbeitsluft ein. Nachdem auf diese Weise die Maschine mit trockener Arbeitsluft gefüllt und die Minimalspannung

Fig. 277.



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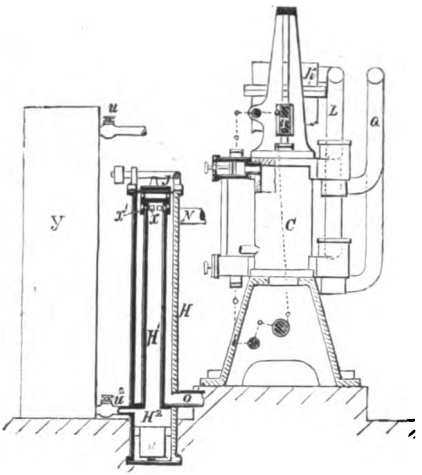
erreicht ist, werden Maximal- und Minimalspannung der Arbeitsluft constant bleiben, da sie automatisch regulirt werden durch Luftspeiser C^1, Reservoir Y und Druckreducirventil J. Wird die Arbeit der Maschine für längere Zeit unterbrochen, so wird durch Schliessen der Absperrventile u^1 und u^2 die im Reservoir Y enthaltene Speiseluft aufbewahrt; beim nächsten Arbeiten der Maschine kann alsdann die letztere sofort mit concentrirter Arbeitsluft nach folgendem Kreislauf gefüllt werden: Aus dem Kälteübertrager R geht die Minimalspannung habende Arbeitsluft durch Q nach dem Compressor C, worin sie auf ihre Maximalspannung comprimirt und infolge dessen erhitzt wird. Von hier wird sie durch Rohr L in den Oberflächenkühler K geleitet; alsdann geht sie durch Rohr M in den Expander E, in welchem sie von ihrer Maximal- auf ihre Minimalspannung expandirt und dabei Kälte und Arbeit producirt. Die letztere wird zur Comprimirung der Arbeitsluft in C verwendet, so dass also der Dampfcylinder S von dieser Comprimirungsarbeit nur einen Teil zu leisten hat. Sobald die Arbeitsluft aus dem Expander E durch Rohr N in den oberen Teil des Raumes zwischen H und H^1 geht, hat sie ihre Minimalspannung und zugleich ihre niedrigste Temperatur erreicht, sie geht jetzt zwischen H und H^1 niederwärts und kühlt dabei die innerhalb der Röhre H^1 aufsteigende Speiseluft auf ihre eigene Temperatur ab. Aus H kommend, gelangt die kalte Arbeitsluft durch Rohr O in den Kälteübertrager R, geht nun durch Q wieder in den Compressor C, worin sie abermals von ihrer Minimal- auf ihre Maximalspannung comprimirt und der eben beschriebene Kreislauf wiederholt wird.

Fig. 278.



B. Proskauer.

XXVIII. Nahrungsmittel.

I. Milch.

1. Physiologisches. Mendes de Léon (Zeitschr. f. Biol. **17**, 501) teilt ausführlich die Untersuchungen über die Zusammensetzung der Frauenmilch mit, welche bereits im Auszuge von J. Forster*) publicirt worden sind. Die Zahlen zeigen ein stetiges Wachsen des Fettgehaltes

*) Techn.-chem. Jahrb. 1883, S. 279.

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in den einzelnen nacheinander entnommenen Proben, selbst wenn die Entleerung der Brustdrüse in 8—9 Portionen geschah. Sobald zwischen den Probenahmen eine Viertelstunde gewartet wurde, war die erste nach der Pause entleerte Portion regelmässig etwas fettärmer, als die vorher entnommene. — Eine Norm für die Zusammensetzung der Frauenmilch lässt sich nicht aufstellen. Im Mittel fanden sich 12·21 Proc. fester Rückstand, 3·89 Proc. Fett, 5·54 Proc. Zucker und 0·25 Proc. Asche. (Vergl. auch Ber. chem. Ges. **15**, 2265.)

Emil Pfeiffer (Berl. Klin. Wochenschr. **20**, 145, 158) veröffentlichte eine Tabelle über vergleichende Eiweiss- und Fettbestimmungen in 53 verschiedenen Muttermilchproben, sowie Untersuchungen über die Menge der abgesonderten Milch und über die Schwankungen derselben (s. Analytisches). — Nach Heinr. Struve (Journ. pr. Chem. N. F. **27**, 249) enthält die Frauenmilch wie die Kuhmilch das Casein teils in ungelöstem, teils in gelöstem Zustande; die Trennung kann man durch Dialyse bewirken (ebend. 231). Ein Teil des ungelösten Caseïns bildet die Hüllen der Fettkügelchen. In der stärker alkalischen Frauenmilch lösen sich die letzteren beim Stehen bald auf, wodurch sich das abweichende Verhalten beider Milcharten gegen Aether (Radenhausen)*) und auch die bei den optischen Fettbestimmungen in der Frauenmilch oft zu niedrig ausfallenden Resultate erklären lassen. Das Casein der Frauenmilch reagirt sauer, wie das der Kuhmilch. Zur Bestimmung des Caseïns neben Albumin in den Fällen, wo das durch Essigsäure und Kohlensäure aus der verdünnten Milch (resp. Rahm) ausgefällte Casein sich nicht gut abfiltriren lässt, erwärmt Verf. die unfiltrirte Flüssigkeit auf dem Wasserbade bis zur Coagulation des Albumins, filtrirt und behandelt den durch Aether entfetteten, bei 100° getrockneten Niederschlag mit Ammoniak, in dem das Albumin unlöslich ist. In verdünnter Kalilauge lösen sich beide Stoffe unter Ammoniakentbindung; aus einer solchen Lösung entwickelt sich beim Kochen und Uebersättigen mit Essigsäure aus dem Albumin, aber nicht aus dem Casein Schwefelwasserstoff. (Ber. chem. Ges. **16**, 1505.)

A. Béchamp (Compt. rend. **96**, 1508; Chem. Centralbl. [3] **14**, 442) fand in der Kuhmilch ausser Casein noch zwei verschiedene Eiweisskörper, von denen der eine, durch Alkohol gefällt, in Wasser löslich bleibt. Dies ist die Galaktozymase, die Stärkekleister verflüssigt ohne das Amylum zu saccharificiren. Verf. hat die Methode, nach der er die Kuhmilch analysirt hat, auch bei der Frauenmilch anzuwenden versucht, doch ohne Erfolg. Dies rührt daher, dass die Eiweisskörper bei anderen Milcharten nicht die gleichen sind. Die Zymase (Enzym) der Frauenmilch verflüssigt und saccharificirt den Stärkekleister unter den gleichen Umständen mit derselben Intensität wie die Diastase; übrigens ist das Rotationsvermögen dieser Zymase bedeutend grösser, als das der Galaktozymase der Kuhmilch. Um die saccharificirenden Eigenschaften der Frauenmilch-Zymase zu zeigen, säuert man die in

*) Techn.-chem. Jahrb. 1883, S. 278.

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normalem Zustande alkalisch reagirende Frauenmilch durch Salpetersäure schwach an und versetzt sie mit wenigstens dem dreifachen Volumen 95° Alkohol. Der voluminöse Niederschlag wird gesammelt, mit schwächerem Alkohol der Milchzucker ausgewaschen, mit Aether das Fett daraus extrahirt und schliesslich mit destillirtem Wasser wieder aufgenommen. Nach einigen Stunden der Berührung erhält man nach dem Filtriren eine Flüssigkeit, welche den Stärkekleister zu verflüssigen und verzuckern vermag. 20 bis 30 cbcm Milch genügen für den Versuch; wenn man zur Wiederaufnahme des Niederschlages nicht mehr als 10 cbcm Wasser angewandt hatte, so kann die erhaltene Lösung 20—30 cbcm Stärkekleister mit $^1/_{25}$ Stärkegehalt verflüssigen und invertiren.

Schmidt-Mülheim hat eine Reihe von Abhandlungen über die Stickstoff-Substanzen der Milch publicirt. Um die Bildung von Casein aus Albumin zu prüfen, wurde das Casein durch verdünnte Essigsäure und Einleiten von Kohlensäure aus der 20fach verdünnten Milch ausgefällt, gewaschen und entfettet. Zur Ausfällung des Albumins wurde das Filtrat unter Zusatz von Essigsäure aufgekocht. Das Filtrat vom Coagulum gab beim Einengen noch eine zweite Ausscheidung, welche mit der ersten vereinigt wurde. Das Resultat der Versuche war, dass das Albumin der Milch durch 6—24stündige Digestion durchaus keine Aenderung erleidet, das Casein dagegen in merklichem Grade an Menge abnimmt, entgegen der Angabe von Kemmerich. Die procentische Abnahme des Caseïns beträgt nach sechs Stunden 4·17 Proc., nach 8 Stunden 9·45 Proc., nach 24 Stunden 16·59 Proc. (Pflüg, Arch. **28**, 243; Chem. Centralbl. [3] **14**, 245.)

Mit der Abnahme des Caseïns bei der Digestion geht eine Zunahme des Peptongehaltes parallel. Im Maximum stieg der Peptongehalt, der in der frischen Milch zwischen 0·08 und 0·19 Proc. lag, auf 0·33. Wird die Milch vorher aufgekocht, so findet die Peptonbildung nicht mehr statt, sie beruht also auf einem fermentativen Processe. Derselbe wird durch Zusatz von Salicylsäure und Carbolsäure nicht gehindert. Dieser Umstand legt den Gedanken nahe, dass das Ferment Pepsin sei, doch gelang der Nachweis desselben nicht. Das Albumin zeigt keine Verminderung bei fortgesetzter Digestion bei 40°. (Pflüg, Arch. **28**, 287.)

Die von Eiweiss und Pepton befreite Kuhmilch enthält in 100 cbcm 40—50 mg Stickstoff. Nach Bouchardat und Quevenne beträgt der Harnstoffgehalt in den Molken nur 0·0079 und 0·0103 Proc. (Lefort fand 0·0073 Proc. in der Milch); es müssen mithin noch andere Stickstoffkörper darin vorkommen. Von den beiden Genannten ist Lecithin aufgefunden worden, welches nach Verf. in einer Menge von 0·0038 Proc. für Molken berechnet, für Butter 0·1736 resp. 0·153 Proc. vorhanden ist (bestimmt in dem ätherlöslichen Teile des heiss bereiteten Alkoholextractes aus dem Phosphorgehalte). Wahrscheinlich findet sich auch Hypoxanthin in der Milch vor. (Pflüg, Arch. **30**, 379.)

Verf. behandelte den Aetherextract süsser Magermilch mit alkoholischer

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Kalilauge und schüttelte den Rückstand mit Aether aus. Er erhielt dabei eine Substanz, löslich in Alkohol-Aether, welche in rhombischen Tafeln (mit Winkeln von 87°) krystallisirte, und sich Chloroform und concentrirter Schwefelsäure gegenüber analog dem Cholesterin verhielt. (Ebend. 384.)

Aus der Abhandlung von Olaf Hammarsten (Zeitschr. phys. Chem. 7, 227): „Zur Frage, ob das Casein ein einheitlicher Stoff sei" heben wir die Analyse des Caseïns hervor: Das Casein enthält 52·96 Proc. Kohlenstoff, 7·05 Proc. Wasserstoff, 15·65 Proc. Stickstoff, 0·847 Proc. Phosphor und 0·716 Proc. Schwefel.

Adolf Baginsky (Zeitschr. phys. Chem. 7, 354) prüfte, in wie weit die neuen Conservirungsmethoden der Milch, welche im Wesentlichen auf eine Ueberhitzung derselben auf 120° C. (Scherff) und auf wasserentziehung nach Anwendung hoher Temperaturen (Romanshorn) hinauskommen, die Constitution dieses wichtigen Kindernahrungsmittels verändern können? Es lag nahe, daran zu denken, dass unter den genannten Verhältnissen die phosphorhaltigen Körper, Nucleïn und Lecithin, Zersetzungen erleiden. Verf. bestimmte den Phosphor- bezw. Phosphorsäuregehalt sowohl des nach dem Hoppe-Seyler'schen Verfahren herausgefällten Caseïns als auch in dem Filtrate des letzteren (Molken). Es ergab sich in dem Phosphorsäuregehalte beider ein nahezu constantes Verhältnis, nämlich von 1 : 3·29 bis 1 : 3·35. Das fast gleiche Verhältnis fand sich in der Romanshorner Milch 1 : 3·10, wogegen die conservirte Milch von Scherff das Verhältnis 1 : 3·94 bis 1 : 5·3 ergab. Bei einem zweiten Versuche mit roher Milch und nachdem dieselbe nach Scherff conservirt war, lieferte die erstere das Phosphorsäureverhältnis (Caseïn-Niederschlag zu den abfiltrirten Molken) wie 1 : 3·05, die letztere 1 : 3·76, also geringer als oben. Aus dieser eigentümlichen Veränderung des Verhältnisses könnte man den Schluss ziehen, dass durch die Conservirung der Milch mittelst hoher Temperaturen auch gleichzeitig eine wesentliche Verbesserung der Milch eingetreten ist. Diese Auffassung wäre zulässig, wenn sich erweisen liesse, dass der Phosphorsäuregehalt in dem auf dem Filter verbliebenen Niederschlage wesentlich dem Nucleïn, das sich als unverdaulich erwiesen hat, angehört, also das letztere durch die Conservirung gleichsam aufgeschlossen worden wäre. Bei der Frauenmilch stellt sich das obige Verhältnis der Phosphorsäure im Niederschlag und Molke durchschnittlich wie 1 : 2·3, nähert sich also mehr der rohen, als durch Ueberhitzen conservirten Milch.

Bouesco untersuchte Büffelmilch:	Morgenmilch	Abendmilch
Wasser	79·97	79·78
Caseïn	7·86	7·06
Butter	6·12	8·04
Albumin	0·25	0·37
Asche	1·04	0·82
Zucker	4·76	3·93

(Journ. Pharm. Chim. [5] 6, 396.)

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Ueber blaue Milch hat J. Reiset (Compt. rend. **96**, 682, 745) eingehende Untersuchungen angestellt. Diese Milchkrankheit, welche vermutlich bei schlechter Ventilation der Aufbewahrungsorte der Milch entsteht, wird durch einen blauen, bis 20 mm lang werdenden Pilz hervorgebracht. Die Krankheit ist durch Reinigen der Gefässe mit kochendem Wasser zu heilen. Bürsten und Tücher müssen dabei vermieden werden. Um blaue Milch wieder genussfähig zu machen, fügt man zu 1 l derselben 0·5 g Essigsäure im Verhältnis von 10 Teilen Eisessig auf 1 Teil Wasser.

2. Analytisches. P. Vieth (Analyst 8, 33) veröffentlicht eine Reihe von Milch-Analysen, welche er während des Jahres 1882 in London ausgeführt hat. Den niedrigsten Gehalt an festen Bestandteilen und an Fett besass die Milch im Monat März (im Mittel 12·73 Proc. Rückstand und 3·16 Proc. Fett), den höchsten im November (13·40 Proc. und 3·82 Proc.). Bei 250 täglichen Milchproben wurde das Vol.-Gew. zwischen 1·030 und 1·033 gefunden, einige Male stieg dasselbe auf 1·034, es fiel aber kaum unter 1·030. — M. Schrodt und H. v. Peter (Forsch. a. d. Gebiete d. Viehhaltung etc. 1883, Heft 13, 199) teilen die Resultate der Controle über die nach einer holsteinischen Molkerei gelieferten Milch mit. Danach schwankt das Vol.-Gew. der Milch von Stapeln bis incl. 5 Kühen zwischen 1·0263 und 1·0338 bei 15° C. und beträgt das Mittel aus 35 Bestimmungen 1·0307. Für das Vol.-Gew. der Milch von über 5 Kühen belaufen sich dagegen die Schwankungen auf 1·028—1·0349; das Mittel aus 449 Bestimmungen hierbei beträgt 1·03199. Der Fettgehalt der Milch weist im ersten Falle (Stapel bis incl. 5 Kühen) Schwankungen auf: 2·66—3·79 Proc.; Mittel aus 35 Bestimmungen: 3·12 Proc. Im anderen Falle: 2·56—4·27 Proc., Mittel von 445 Bestimmungen 3·22 Proc. Der Fettgehalt bei Weidegang und Winterstallfütterung schwankte bei Stapeln von mehr als 5 Kühen von 2·63—4·27 Proc. bei Weidegang und Winterstallfütterung mit Schlempe von 2·66—3·47 Proc., bei durchgängiger Stallfütterung von 2·56—3·58 Proc. — James Bell (Analyst 8, 141) fand in der

Milch von Einzelkühen:	Mischmilch:
8·00—11·27 Proc. entfettete Trockensubstanz,	8·50—9·91 Proc. entfettete Trockensubstanz,
1·92—6·87 Proc. Fett,	2·95—5·14 Proc. Fett,
0·62—0·87 „ Asche.	0·63—0·73 „ Asche.

J. Skalweit (Repert. d. anal. Chem. **3**, 202) sucht nachzuweisen, dass Grenzzahlen, wie solche mit der Vorlage betr. die Controle der Milch der landwirtschaftlichen Section des Volkswirtschaftsrates zugegangen sind (Spec. Gew. 1·0285—1·0340; Fettgehalt 2·5 Proc., Trockensubstanz 10·0 Proc. für ganze Milch), für die Beurteilung der Milch ohne Wert sind. Durch einfache Schlussfolgerungen aus den vier Daten: Spec. Gewicht, Fett, Trockensubstanz, Asche — und sachgemässer Ueberlegung lasse sich, ohne Grenzzahlen und Gesetze, mit Bestimmtheit eine Verfälschung der Milch nachweisen.

G. Recknagel (Milchztg. 1883, 419, 437) hat die Eigenschaft der

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Milch, sich zu verdichten, d. h. mehrere Stunden nach dem Melken ein um $^1/_2$—1° Quevenne höheres spec. Gew. anzunehmen als sie unmittelbar nach dem Melken besitzt, näher studirt. Er kommt zu folgenden Schlüssen:

1. In der Milch beginnt einige (2—3) Stunden nach dem Melken ein Verdichtungsprocess, welcher sich, falls die Temperatur nahezu auf 15° C. erhalten wird, zwei Tage hindurch mit abnehmender Geschwindigkeit fortsetzt.

2. Die Stärke der vollen Verdichtung beträgt 0·8—1·5° Quevenne. Sie ist um so grösser, je gehaltreicher die Milch ist.

3. Die Verdichtung der Milch kann durch Abkühlen derselben unter 15° C. beschleunigt werden. Man erhält sicher die volle Verdichtung und somit das normale spec. Gew. der Milch, wenn man dieselbe 6 Stunden lang auf einer Temperatur von 5° C. oder darunter erhält. Wahrscheinlich genügt aber in den meisten Fällen eine geringere Zeit.

4. Milch, welche nach dem Melken auf 15° abgekühlt und annähernd auf dieser Temperatur erhalten wird, erfährt in 12 Stunden eine Dichtigkeitszunahme von 0·5° Quevenne. — Erwärmen der Milch von 15—20° C. bewirkt eine Abnahme um 0·2°, von 15—25° C. um 0·4°, von 15—30° C. um 0·7° Quevenne, noch grösser ist sie beim Erwärmen auf 50° C. — Die so nach dem Melken vor sich gehende Verdichtung der Milch wird durch das Quellen des Caseïns verursacht.

Für die Beurteilung der Güte einer Milch ist nach W. Chludsinsky (Landw. Jahrb. **11**, 835) unbedingt erforderlich, das spec. Gewicht der ganzen Milch, die Volumprocente des in 36—48 Stunden abgesetzten Rahmes und das spec. Gewicht der entrahmten Milch zu ermitteln. Diese drei Bestimmungen werden in einem cylindrischen Glasgefässe ausgeführt, das 1 l Milch fasst. An dem oberen Teile desselben befindet sich eine 0·1 cbcm Einteilung zum Ablesen der Volumprocente des Rahmes. Die untere Oeffnung des Gefässes wird durch einen auf einem Stativ befestigten Glasstöpsel verschlossen. Durch Wägung von 1 l Milch von 18° C. wird das spec. Gewicht derselben ermittelt. Ist dasselbe kleiner als 1·028, so ist die Milch mit Wasser versetzt, ist es grösser als 1·031, so ist Salz (? d. R.) zugefügt. Normale Milch enthält 9—14 Vol.-Proc. Rahm, magere oder mit Wasser versetzte weniger. Zur Ermittelung des spec. Gewichtes des Milchserums werden durch Oeffnen des Glasstöpsels genau 500 cbcm ausfliessen gelassen und das Gefäss zurückgewogen. Da das spec. Gewicht des Serums 1·032—1·036 beträgt, so wird der Gewichtsverlust bei normaler Milch 516—518 g betragen. Bei Salzzumischung wird derselbe höher, bei Zusatz von Wasser zur Milch geringer sein. Verfasser nennt seinen Apparat „Gewichtslactometer".

Ueber die Abnahme des Trockenrückstandes der Milch durch Zersetzung desselben ist von P. Vieth (Analyst **7**, 213) festgestellt worden, dass dieselbe beim längeren Stehen der Milch eintritt. Diese Abnahme wird durch Bedingungen, welche einer Zersetzung ungünstig sind, z. B. durch Kälte begrenzt. Milch, die während der kälteren Nachtzeit trans-

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portirt ist, hält sich länger als solche, welche während der wärmeren Tageszeit befördert worden war. Die Verminderung der Trockensubstanz tritt mit dem Sauerwerden der Milch ein, d. h. mit dem Zerfall des Milchzuckers in Milchsäure. Daneben müssen sich noch weitere flüchtige Verbindungen z. B. Alkohol bilden.

Auf Grund von vergleichenden Untersuchungen über die Bestimmung der Trockensubstanz in der Milch kommt Schmidt-Mühlheim zu dem Ergebnis (Pflüger's Arch. **31**, Heft 1 und 2), dass das Haidlen'sche Verfahren (Eintrocknen mit Sand bei fast 100° C.) seiner Einfachheit und seiner hinreichend genauen Resultate wegen allgemeinen Eingang in die Praxis verdiene, wenngleich seine Werte regelmässig um ein Geringes höher liegen (0·05 — 0·1 Proc.) als die durch das Eintrocknen der Milch im Wasserstoffstrome erhaltenen. Die Methode von Gerber und Radenhausen (Eindampfen unter Zusatz von Alkohol oder Essigsäure) sei umständlicher und keineswegs zuverlässiger, als Haidlen's Verfahren. — Nach M. Schmoeger (Ibid. Heft 7 u. 8) geben die Bestimmungen nach Haidlen Differenzen, die sich fast immer nur auf die zweite Decimalstelle erstrecken. Den Trockensubstanzgehalt mittelst dieser Methode fand er ebenso hoch, wie den nach den Vorschriften von Gerber und Radenhausen gefundenen. Es dauert nach dem letzteren Verfahren länger, bis man ein constantes Gewicht erhält. Mit der Haidlen'schen Milchrückstandsbestimmung kann man zudem die Fettbestimmung sehr gut vereinigen. Man muss das Eindampfen der Milch mit Sand auf dem Wasserbade ganz zu Ende führen, ehe man den Rückstand in den Trockenschrank bringt. Beim Eintrocknen im Wasserstoffstrome erhielt Schmoeger etwas niedrigere Zahlen, als bei den anderen Methoden.

Bei der Ermittelung des Rahmgehaltes der Kuhmilch bedient sich A. Gawalovsky (Rundschau **9**, II. 474) als Messgefäss eines Erlenmeyer'schen Kölbchens. Der untere erweiterte Teil fasst bei 15° C. bis zur Halsverengerung $^1/_4$ Liter, von da an sind auf dem Halse 20 Teilstriche (à $2^1/_2$ cbcm entsprechend) aufgetragen. Jeder Teilstrich erscheint ausserdem in $^1/_{10}$ geteilt. (Bei Fischer & Röwer in Stützerbach zu beziehen.) Man füllt den Kolben bis zur Marke mit der Milch und setzt ein wenig wasserlösliches Anilinblau hinzu, schüttelt gelinde und lässt 24 Stunden an einem kühlen Orte stehen. Nach dieser Zeit (im Sommer früher) scheidet sich der Rahm im Halse des Cremometers als weisse Schicht ab, welche sich von der blauen gefärbten Milch scharf abhebt. Man stellt das Cremometer in Wasser von 15° C. und liest den Stand des Rahmes nach $^1/_2$—1 Stunde ab, was infolge der roten Beizung der Teilstriche und bei der grossen Distanz der einzelnen Zehntelgrade bis auf $^1/_4$ Zehntel exact geschehen kann. Die Ablesung ergiebt direct Vol.-Proc. Rahm. Das Cremometer ist bestimmt, nur den sicheren Vergleich des Rahmgehaltes mehrerer Milchsorten zu ermöglichen und erfüllt bei richtiger Handhabung seinen Zweck. Da die Angaben der Capacität gemäss in $^1/_{100}$ Vol.-Proc. möglich sind, nennt Verf. das Instrument „Centesimal-Cremometer."

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H. Vogel (Rep. anal. Chem. 3, 49) hält das Feser'sche Lactoskop zu forensischen Zwecken für unbrauchbar.

Ueber die Beziehungen zwischen dem specifischen Gewicht, dem Fettgehalte und dem Gehalte an Trockensubstanz in der Milch schrieben O. Fleischmann und Morgen (Journ. für Landw. 1882) und Hehner (Analyst, 7, 129). Erstere fanden das spec. Gewicht der fettfreien Trockensubstanz zu 1·5847 und das des Milchfettes auf Grund älterer Bestimmungen zu 0·94 und berechnen den Procentgehalt der Milch an Trockensubstanz (t) aus der Gleichung $t = a$. 1·173+2·71 (100—100/s), wobei a Fettprocente und s das spec. Gewicht der Milch bedeuten. Der Fettgehalt a ist dann = t. 0·852—2·31 (100—100/s). Die nach diesen Gleichungen berechneten Zahlen weichen von den analytisch gefundenen im Maximum um 0·24 Proc. ab und differiren durchschnittlich erst in der dritten Decimale. — Hehner suchte zu ermitteln, ob das spec. Gewicht der Trockensubstanz, welche entfettet ist, hinreichend constant ist, um für die Milchuntersuchung verwertet werden zu können; man würde alsdann, wie dies F. Clausnitzer und Adolph Mayer*) angestrebt haben, im Stande sein, aus dem spec. Gewichte und der Gesamttrockensubstanz die entfettete Trockensubstanz und somit auch den Fettgehalt zu bestimmen. Verf. geht davon aus, dass wenn jedes Procent von entfetteter Trockensubstanz (S) das spec. Gewicht der Milch (G) über 1·000° (d. i. 0·001) zu dem Factor s erhebt, jedes Procent von Fett (F) dasselbe zu der Zahl f erniedrigt. Ist T der Gesamtrückstand, so würde $S = \frac{G+Tf}{s+f}$ sein. Während Clausnitzer und Mayer den Wert für f zu 1·00 (0·001°) angeben, berechnet Hehner denselben nach den Untersuchungen von Wynter Blyth (Analyst 5, 76) und von Wigner] (Ibid.] 4, 184) zu 0·725 (0·000 725). Aus einer Reihe von Versuchen hat Verf. ferner ermittelt, dass jedes Procent der festen Bestandteile minus Fett, also s, das spec. Gewicht der Milch um 3·605 (0·003605) erhöht; dieser Factor gilt auch für abgerahmte und sehr fettreiche Milch. Nach Einschaltung dieser Werte in die obige Formel erhält man $S = \frac{G+T.0.725}{4.33}$ d. h. man erhält die Trockensubstanz weniger Fett, wenn man die Gesamttrockensubstanz mal 0·725 zum specifischen Gewicht der Milch addirt, und die Summe durch 4·33 dividirt. Trockensubstanz minus Fett vom Gesamtrückstand subtrahirt ergiebt den Fettgehalt. Eine Differenz von 0·1 der spec. Gewichtsbestimmung bewirkt eine Differenz von 0·023 Proc. bei dem berechneten Resultate und ein Fehler von 0·1 Proc. bei der Gesamttrockensubstanz einen solchen von 0·017 Proc. an Nichtfettfixum. Verf. giebt schliesslich eine Tabelle zur Berechnung des entfetteten Trockenrückstandes aus dem spec. Gewicht und Gesamtrückstand.

P. Vieth (Forsch. a. d. Geb. d. Viehhalt. 1883, Heft 14, 247) hat die

*) Techn.-chem. Jahrb. 1882, S. 222.

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vorerwähnten Arbeiten von Clausnitzer & Mayer, von Fleischmann & Morgen, von Hehner und die von Behrend & Morgen (welch' letztere auf Grund der Bestimmungen des spec. Gewichtes und des Fettgehaltes die Trockensubstanz aus einer Formel berechnen*)) einer vergleichenden Betrachtung unterworfen und macht vor allem in Uebereinstimmung mit Hehner aufmerksam, dass bei Beurteilung und Vergleichung der Resultate, welche man bei Benutzung der verschiedenen Formeln erhält, berücksichtigt werden muss, dass die Formeln auf Zahlen beruhen, die unter Anwendung sehr verschiedener Methoden erhalten wurden. Für alle Fälle, in welchen eine Wertbestimmung der Milch wünschenswert oder notwendig, eine eingehende analytische Untersuchung aber überflüssig oder unmöglich sei, empfehle sich die Bestimmung des spec. Gewichtes und des Fettgehaltes und die Berechnung des Trockensubstanzgehaltes unter Anwendung der Formel von Fleischmann & Morgen. Das spec. Gewicht ist mit dem Laktodensimeter, das Fett nach Soxhlet's aräometrischer Methode oder mittels des etwas weniger zuverlässige Resultate ergebenden Laktobutyrometers zu bestimmen.

Die volumetrische Methode zur Fettbestimmung in der Milch von Leo Liebermann (Zeitschr. f. anal. Chem. **22**, 383) beruht darauf, dass man in einem gut verschliessbaren 3—$3^1/_2$ cm weiten ca. 26 cm hohen Glascylinder 50 cbcm der gut durchgeschüttelten Milch mit 5 cbcm Kalilauge von 1·2 spec. Gewichte und 50 cbcm wasserhaltigen Aether 1—2 Minuten gut schüttelt, bis die Milch eine gelblich homogene Masse bildet und die weissen Krümel alle verschwunden sind. Man legt den Cylinder schief und lässt die Milch von der Aether-Fettlösung sich abscheiden. Von der Aetherfettlösung pipettirt man 20 cbcm, enthaltend das Fett von 20 cbcm Milch, ab und bringt dieselben in ein 50 cbcm fassendes Kölbchen, dessen Rauminhalt man mit destillirtem Wasser von der Zimmertemperatur vorher genau bestimmt hat. Der Aether wird verdunstet, das Fett (bei 100 bis 105°) getrocknet und dann bis auf Zimmertemperatur abgekühlt. Das Kölbchen wird jetzt wieder auf die nämliche Weise unter denselben Bedingungen zuerst aus einer Bürette, dann aus einer in $^1/_{100}$ cbcm geteilten Messpipette mit destillirtem Wasser gefüllt. Die Differenz der jetzt gebrauchten Cubikcentimeter Wasser von dem Rauminhalt des Kölbchen abgezogen, drückt die Menge Milchfett in Cubikcentimeter aus, welche in 20 cbcm Aether resp. Milch enthalten war. Zur Umrechnung der Volumprocente Fett in Gewichtsprocente dient eine vom Verf. mitgeteilte Tabelle. C. H. Wolff (Pharm. Centralh. N. F. **4**, 435) hat beim Vergleich des Resultates einer auf diese Weise ausgeführten Fettbestimmung mit dem Resultate des gewichtsanalytischen Verfahrens gefunden, dass jene Methode um 0·2 Proc. zu hohe Zahlen ergiebt. Dieser Unterschied hat darin seinen Grund, dass bei den gewählten Verhältnissen eine Verringerung des Aethervolumens um 5 cbcm stattfindet, so dass also 20 cbcm Aetherfettlösung nicht

*) Techn.-chem. Jahrb. 1882, S. 222.

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mehr 20 cbcm Milch entsprechen können. Wolff modificirt die Methode dahin, dass er 50 cbcm Milch mit 3 cbcm Kalilauge (1·145 der Pharmakopöe) und 54 bez. 55 cbcm wasserhaltigen Aether schüttelt. 20 cbcm der aetherischen Fettlösung werden in einem tarirten Kölbchen verdunstet und das restirende Fett gewogen; letzteres mit 5 multiplicirt giebt Gramm Fett in 100 cbcm Milch.

E. Pfeiffer giebt an (Zeitschr. f. anal. Chem. **22**, 14), dass für die Coagulation der Muttermilch sich Salzsäure (2·2 g der officinellen Säure auf 100 g Wasser) besser eigne, als Essigsäure, da die Gerinsel mit letzterer so fein werden, dass nicht leicht ein klares Filtrat zu erzielen ist. Man nimmt 10 g Milch zur Caseïnbestimmung, vermischt sie mit der erforderlichen, vorher ermittelten Salzsäuremenge, filtrirt vom Coagulum, wäscht das Casein aus, befreit es im Soxhlet'schen Apparate vom Fett, und wägt es nach dem Trocknen. Das Albumin fällt man durch Kochen des vom Caseïn befreiten Filtrates; die Bildung von Flocken wird mitunter durch Zusatz von 1—2 Tropfen Salzsäure gefördert. Im Filtrate von der Albuminbestimmung bleiben Eiweisskörper zurück, die durch Tannin gefällt werden. Diese Körper scheinen zur Klasse der Peptone zu gehören und finden sich auch in der Kuhmilch. Verf. nennt dieselben den „Eiweissrest". Zur quantitativen Bestimmung desselben bringt man das von obigen Bestimmungen restirende Filtrat auf ein bestimmtes Volumen und setzt für je 10 cbcm desselben 1 cbcm einer 10proc. Tanninlösung hinzu. Der Niederschlag wird auf ein gewogenes Filter gebracht, ausgewaschen, getrocknet und gewogen. Der Rückstand ist der Eiweissrest. Der Caseïngehalt der Milch gesunder Frauen beträgt im Mittel 1·2 Proc. und das Gesamteiweiss 1·6—1·7 Proc. Der Eiweissrest der Kuhmilch betrug einer Reihe von Analysen zufolge 0·371 Proc. bei einem Caseïngehalte von 2·329 Proc. und einem Albumingehalt von 0·224 Proc.

In Bezug auf die Nachweisung von Milchverfälschungen mittelst des Refractometers von Abbe hat Alfred Jörgensen (Landw. Jahrb. 1883, 701) gefunden, dass die Milchkügelchen keinen Einfluss auf den Brechungsindex ausüben; der Apparat giebt nur über die Beschaffenheit des Serums Aufschluss. Der Brechungsindex der Milch liegt zwischen 1·3470 und 1·3515; derselbe steht in keinem Verhältnis zum Fettgehalte, da eine sehr magere Milch einen sehr hohen Index gab. Ein Zusatz von 10 Proc. Wasser zur Milch bewirkt einen unter der niedrigsten Grenze stehenden Index, welchen die untersuchte Milch überhaupt zeigt. Ein Zusatz von abgerahmter zur ganzen Milch lässt sich auf diese Weise nicht ermitteln. — Die Molken von verschiedenen Milchsorten, welche mittels Labflüssigkeiten erhalten worden waren, gaben eine Brechung von 1·3465—1·3433; die stärkste Brechung war nur einmal gefunden worden, und die geringste und stärkste bei der Untersuchung der Milch einer Kuh. Eine Mischung der Milch von mehreren Kühen ging niemals unter 1·3435 herunter. Am allerhäufigsten, wenn Milch von grösseren oder kleineren Viehständen geprüft wurde, lag der Index zwischen 1·3440—1·3455, also innerhalb sehr enger Grenzen. Verf. schliesst, dass die Molken in der überwiegenden Mehrzahl von Einzelfällen

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bei einem Zusatz von 10 Proc. Wasser einen Brechungs-Index ergeben würden, der unter der angeführten absoluten Minimumsgrenze liegt, und lass sehr oft ein viel geringerer Zusatz sicher nachgewiesen werden kann. Ausnahmen von dieser Regel finden nur bei der Milch einer Kuh, niemals bei Mischmilch desselben Viehstandes, selbst wenn dieser klein war, statt. —

Den Nachweis des Zusatzes kleiner Mengen Wassers zur Milch gründet J. Uffelmann (Deutsche Vierteljahrsschr. f. öffentl. Gesundh.-Pfl. **15**, 663) darauf, dass Ammoniak, salpetrige Säure, Salpetersäure in Brunnenwasser fast immer vorkommen, während diese Bestandteile in der Milch fehlen.

Nach W. Bachmeyer (Zeitschr. f. anal. Chem. **21**, 548) wird ein Sodagehalt der Milch bis zu 0·3 g im l durch die grüne Färbung erkannt, welche dieselbe nach Zusatz von 3—5 cbcm Tanninlösung zu etwa 15 cbcm nach 8—12stündigem Stehen annimmt. Untrüglich ist der Nachweis, wenn durch Zusatz von etwas verdünnter Essigsäure die grüne Farbe in ein vorübergehendes Rot verwandelt wird. Die zu untersuchende Milch muss alkalisch sein.

Um Salicylsäure in der Milch zu bestimmen, wendet A. Rémont (Bull. Soc. Chim. **38**, 547) 20 cbcm Milch an, die er mit 2—5 Tropfen Schwefelsäure bis zur Bildung einer gleichmässigen Mischung und dann mit 20 cbcm Aether schüttelt. 10 cbcm des Aetherextracts werden verdunstet, der Rückstand mit 10 cbcm 40procentigen Alkohol ausgekocht und nach dem Abkühlen filtrirt. 5 cbcm dieses Filtrats, welche der Hälfte der angewandten Milch entsprechen, werden in einer graduirten 15 mm weiten Röhre mit 2—3 Tropfen Eisenchloridlösung (1 : 100) versetzt. Die Intensität der dabei entstehenden violetten Färbung vergleicht man mit einer Flüssigkeit, welche man in gleicher Weise aus reiner Milch darstellte, der man 0·1 bis 0·2 g Natriumsalicylat per Liter zusetzt. Die Untersuchung der Butter geschieht auf dieselbe Art; man kocht 10 g davon mit 50 cbcm 40procentigen Alkohol und bestimmt, wie vorhin, colorimetrisch. – Im städtischen Laboratorium zu Paris weist Ch. Girard (Documents sur les falsific. des mat. aliment. etc. 238) die Salicylsäure in der Milch nach, indem er 100 cbcm der letzteren mit 100 cbcm Wasser auf 60° C. erwärmt, dann 8 Tropfen Essigsäure und ebenso viel Mercurinitrat (frei von Mercurosalz) hinzufügt und nach dem Erkalten filtrirt. Das Filtrat wird mtt 50 cbcm Aether ausgeschüttelt, die ätherische Lösung verdunstet, der Rückstand getrocknet und mit einem aliquoten Teil die Eisen- oder Kupferreaction ausgeführt. Die Krystalle kann man in alkoholhaltigem Wasser lösen und mit titrirter Natronlösung die Quantität der Säure ermitteln.

Zur Prüfung auf Benzoesäure und Borsäure in der Milch werden nach E. Meissl (Zeitschr. f. anal. Chem. **21**, 231) 250—500 cbcm Milch mit Kalk- oder Barytwasser alkalisch gemacht, auf $^1/_4$ eingedampft, mit Gyps oder Sand zu einem Brei eingerührt und eingetrocknet (von condensirter Milch nimmt man 100—150 g). Die getrocknete Masse säuert man mit Schwefelsäure an, schüttelt sie mit 50 Proc. Alkohol aus, filtrirt die alkoholische Lösung, dampft sie mit Barytwasser ein und extrahirt mit Aether die Benzoesäure.

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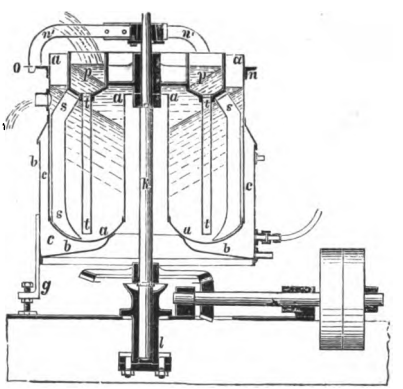
Der Gewichtsverlust des bei 60° getrockneten Rückstandes nach Sublimation der Benzoesäure giebt die Menge derselben. Zum Borsäurenachweis werden 100 cbcm Milch mit wenig Kalk alkalisirt und verascht. Die Asche wird in wenig concentrirter Salpetersäure gelöst und eingedampft, darauf mit verdünnter Salzsäure und Curcumatinctur durchfeuchtet, bei Gegenwart von Borsäure (bis 0·001 Proc.) ist dieselbe nach dem Eintrocknen zinnober- bis kirschrot gefärbt. Concentrirte Salzsäure giebt zwar mit Curcumatinctur auch eine rote Färbung, die aber auf Zusatz von Wasser verschwindet und beim Trocknen braun wird, während die Borsäurefärbung erst beim Trocknen erscheint und erst dann durch viel oder kochendes Wasser aufgehoben wird.

Conserviren und Condensiren der Milch. B. Dietzel (Zeitschr. d. landw. Ver. in Bayern, 1882, 511) erhitzt zur Praeservirung der Kuhmilch dieselbe in luftdicht verschlossenen Flaschen auf 115° C. In den Flaschen bleibt ca. der 15. Teil des Volumens, das sie zu fassen im Stande sind, ungefüllt. — Auguste Bertling hat einen Milchkochapparat (D. P. 18318) patentirt. — Zum Kochen der Milch, um dieselbe für einige Tage haltbar zu machen, benützt Soltmann (Deutsch. Med.-Wochenschr. 1882, 70.) einen Cylinder aus verzinntem Eisenblech, welcher unten mit einem verschiebbaren und mit Einschnitten versehenen Trichteransatz versehen ist. Oben ist er mit einer bogenförmig geschlossenen Kappe geschlossen, an dem sich 3 nach abwärts gerichtete kurze Röhrchen befinden. Beim Kochen tritt nun die Milch unten aus und fliesst durch die drei oberen Rohrchen wieder in den Topf zurück. — Der Apparat von Albert Fesca in Berlin (D. P. 18782 (Fig. 278) gestattet das Erwärmen der Milch bei continuirlichem Zu- und Abfluss und besteht aus dem als Rotationskörper gebildeten, mit Dampfmantel *b e* umgebenen Gefäss *a*, das mit einem abnehmbaren Rührwerk versehen ist. Dies besteht aus der mit Armkreuz und Nabe versehenen ringförmigen Rinne *p*, in welche die Milch eintritt, in Verbindung mit Röhren *t*, welche die kalte Milch direct auf den Boden des Gefässes leiten, sowie den Flügeln *s*, welche die Aussenwand des Gefässes von innen in ihrer ganzen Höhe, sowie einen Teil des Bodens bestreichen, um das Ansetzen fester Stoffe zu verhindern, welche sich beim Erwärmen der Milch ausscheiden. Die Stellschrauben *g*, der abnehmbare Bügel n^1 mit den Nasen *o* dienen dazu, das behufs Reinigens von der Grundplatte abgenommene Gefässe *a* wieder genau in die vorherige Lage zu bringen.

Fig. 278.



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Busse (Chem. Ztg. 6, 1347) wendet zur Conservirung der Milch auf je 1 l derselben 1—2 Theelöffel des käuflichen Wasserstoffsuperoxydes an, worauf die Gerinnung bei 15—18° C. nach 2 bis 3 Tagen, bei 12° C. nach 3—4 Tagen eintritt. Auch Butter, mit Wasserstoffsuperoxyd durchknetet, hält sich längere Zeit. Ranzige Butter kann durch Waschen damit bedeutend verbessert werden.

W. Fleischmann und A. Morgen haben die nach dem Scherff'schen Verfahren conservirte Milch untersucht (Landw.-Vers. Stat. **28**, 321) und gefunden, dass dieselbe kein gelöstes, sondern coagulirtes Eiweiss enthält. Der Kaesestoff wird durch Labzusatz zur Scherff'schen Conserve nicht zum Gerinnen gebracht, durch Milchsäure oder Essigsäure feinflockig gefällt. Die Eiweissstoffe darin sind gegen Pepsin-Einwirkung weniger empfindlich, als diejenigen der frischen Milch. Auch der Milchzucker scheint zum Teil bei der hohen Temperatur, die beim Conserviren angewandt wurde, verändert zu sein.

Ph. Biedert (Berl. klin. Wochenschr. 1882, 75) kommt auf Grund seiner Versuche über Milchconservirung zu dem Schlusse, dass ein dauerndes Conserviren ein 2stündiges Erhitzen der Milch unter Luftabschluss bei 100° verlangt. Ein ebenso langes Erwärmen auf 60° scheint für dauernde Haltbarkeit ungenügend. Dagegen genügt dieses, wie auch das Kochen mit dem Soltmann'schen Apparat für die Aufbewahrung zu Haushaltungszwecken. Das Digeriren der Milch bei 60° macht das völlige Aufkochen nicht entbehrlich, da man dessen bedarf, um sich gegen Krankheitskeime, Perlsucht ect. in der Milch zu schützen.

Den Wert der verschiedenen Milchconserven kritisirt Jacobi (Deutsche Viertelj.-Schrift f. öffentl. Gesundheitspfl. 1882.)

W. F. Sweetland (Engl. P. 1315 vom 18. März 1882) bereitet condensirte Milch nicht unter Zusatz von Zucker, sondern indem er aus Flechten gewonnene Gelatine hinzufügt.

Ueber Zusammensetzung und Untersuchungsmethode condensirter Milch berichten H. Pellet und L. Biard (Rev. des Ind. Chim. et Agric. **6**, 658). Zwei Proben condensirter Milch enthielten:

	Wasser	Asche	Lastose	Krystallis. Zucker	Fett	Stickstoffh. Substanz,
I.	26·08 %	1·70 %	13·80 %	42·80 %	6·87 %	7·31 %
II.	18·06 „	1·70 „	15·80 „	41·00 „	12·00 „	11·44 „

Condensirte Pferdemilch, welche von einer englischen Gesellschaft in Samara, in den Steppen Südrusslands gelegen, ein Zeit lang fabricirt wurde, und mit welcher in einem Kinderhospitale St. Petersburgs Ernährungsversuche angestellt wurden, enthielt nach P. Vieth (Milchztg. **12**, 329.): Wasser 18·80 Proc., Fett 10·08 Proc., Protein 15·23 Proc., Zucker 54·09 Proc., Asche 1·80 Proc. Es ergiebt sich, dass die verwendete Pferdemilch etwa im Verhältnis von 7:1 eingedampft worden ist. Der Pferdemilch wird vor dem Eindampfen Rohrzucker in einer Menge von 2·33 Proc. zugesetzt. Das Butterfett aus condensirter Pferdemilch blieb bei gewöhnlicher Temperatur halbflüssig und

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erstarrte selbst bei dem Gefrierpunkt nahen Temperaturen nicht vollkommen zu einer festen Masse.

Auf Grund wiederholter Versuche stellt Biedert (Rundschau **9**, II. 476) die Behauptung auf, dass reines Kuhcasein weitaus weniger verdaulich ist, als Menschencasein. Ein Kind soll nur so viel Casein erhalten, als es zu verdauen vermag. Biedert vermischt deshalb die Kuhmilch je nach dem Alter des Kindes mit grösserer oder geringerer Menge Rahm.

Für ein Kind von	1	Mon.	1/8	l	Rahm,	3/8	l	Wasser	und	15	g	Milchzucker;		
„ „ „ „	2	„	1/8	l	„	1/16	l	Milch,	3/8	l	Wasser,	15	g	Milchz.
„ „ „ „	3	„	1/8	l	„	1/8	l	„	3/8	l	„	15	g	„
„ „ „ „	4	„	1/8	l	„	1/4	l	„	3/8	l	„	15	g	„
„ „ „ „	5	„	1/8	l	„	3/8	l	„	3/8	l	„	15	g	„
„ „ „ „	6	„	—			1/2	l	„	1/4	l	„	10	g	„

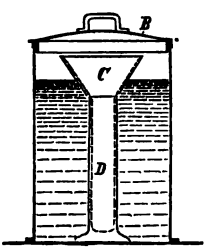
Das Gemenge ist früh und abends frisch zu bereiten und zu kochen.

Zur Herstellung künstlicher Muttermilch setzt Otto Lahrmann in Altona (D. P. 19777) der Milch von Säugetieren nach voraufgegangener Analyse Zucker und Rahm bezw. Wasser zu und behandelt dieselbe darauf mit einem geeigneten Fermente (z. B. Pankreasferment), bis der überschüssige Teil der durch Säure fällbaren Eiweissstoffe in Peptone bezw. peptonähnliche Körper übergeführt ist.

II. Butter.

W. Osten's Apparat zur Butterprüfung (D. P. 19078 und 20695) hat die folgende Construction: Ein Glascylinder ist mit einer Scale versehen, von der 100 Teile den Raum angeben, den 50 g Butter einnehmen. Derselbe wird in ein Gefäss mit warmen Wasser gestellt. Nachdem die Butter mittelst des warmen Wassers zum Schmelzen gebracht und dann wieder erstarrt ist, kann man erkennen, wie viel Fett und wie viel mechanische Beimengungen in dem Butterquantum enthalten sind. Der Einfülltrichter *C* ist statt am Deckel *B* des Wassergefässes *A*, wie nach dem Hauptpatent, direct am Glascylinder *D* angebracht, da sich mit diesem der Trichter leichter verbinden lässt, als mit dem Deckel.

Fig. 279.



Auf Veranlassung von Leo Liebermann hat Alexander Asboth (Zeitschrift f. anal. Chem. **22**, 388) das spec. Gewicht eines reinen Butterfettes bei verschiedenen Temperaturen bestimmt.

Bei	15°	C.	betrug	dasselbe	0·91109	Bei	23°	C.	betrug	dasselbe	0·89216
„	16	„	„	„	·90831	„	24	„	„	„	·88822
„	17	„	„	„	·90642	„	25	„	„	„	·88703
„	18	„	„	„	·90377	„	26	„	„	„	·87584
„	19	„	„	„	·90170	„	27	„	„	„	·87463
„	20	„	„	„	·90034	„	28	„	„	„	·87327
„	21	„	„	„	·89897	„	29	„	„	„	·87191
„	22	„	„	„	·89626	„	30	„	„	„	·87055

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Um den Gehalt an Wasser, Casein und Salz in der Butter zu bestimmen, werden nach A. van Bastelaer (Journ. Pharm. Chim. **6**, 128) 10 g aus der Mitte eines Butterstückes entnommen und bei 100—120° in einer Porcellanschale getrocknet. Der Rückstand wird mit Benzin extrahirt. Das erste Mal wird Benzin nur aufgegossen, ohne umzurühren, weil sonst das Casein sich schwer absetzt. Das Absetzen geschieht um so besser, je vollständiger der Rückstand ohne Ueber schreitung von 120° getrocknet war. Der entfettete Rückstand wird von neuem getrocknet. Der Gewichtsverlust bedeutet Fett. Man äschert hierauf ein, ohne das in der Butter enthaltene Kochsalz zum Schmelzen zu bringen. Die Gewichtsdifferenz entspricht dem Casein, der Rückstand ist Chlornatrium. Verf. stellt als Grenzwerte für Butter auf: Butterfett 85—75 Proc., Wasser 9—15, Casein 1—3, Chlornatrium 5—10 Proc.

Die Gegenwart von Kunstbutter (Oleomargarin) erkennt man: 1. an dem Geruch während der Feuchtigkeitsbestimmung, besonders bei etwas höherer Temperatur, 2. durch den Caseingehalt, in Folge der Beimengung von Milch. Man bemerkt in der geschmolzenen Butter eine grosse Menge käsiger Flocken. Ein grosser Gewichtsverlust beim Einäschern ist ein Zeichen für Anwesenheit von Margarin oder anderer organischer Beimengungen, z. B. Stärkemehl.

Aug. Hansen sagt über den Nachweis fremder Fette im Butterfette (Inaug. Dissert. Erlangen 1882): 1. Die Schmelzpunktbestimmungen sind als Vorprüfungen der Untersuchung der Fette sehr empfehlenswert (reines Butterfett schmilzt bei 33—37° C.). 2. Die Elementar-Analyse der Fette giebt keinerlei Aufschluss, ob Verfälschung stattgefunden hat oder nicht. 3. Butterfett ist gegen Wärme sehr beständig, es lassen sich demnach mittelst der Hehner'schen Methode noch Verfälschungen nachweisen, wenn das Fett nicht augenscheinlich teils für stark verbrannt erklärt werden muss. Die beim stärkeren Erhitzen eintretende Zersetzung beschränkt sich grösstenteils auf die Glyceride der nicht flüchtigen Säuren. 4. Beim Verseifen der Butter nach Hehner tritt keine nachweisbare Verflüchtigung von Aethern ein; ebenso tritt kein Verlust von flüchtigen Fettsäuren bei ihrer directen Verseifung in alkoholischer Lösung auf. 5. Um Verfälschungen im Butterfette nachzuweisen, ist die Methode von Reichert resp. Meissl die sicherste, in zweiter Linie die von Koettstorfer. 6. Nach der vergleichenden Prüfung der einzelnen Methoden ist die Hehner'sche Mittelzahl 87·5 Proc. gleich der von Koettstorfer angenommenen 227 und gleich 28·8 von Reichert-Meissl. Nach Koettstorfer, 221·5 als niedrigstes Grenzgewicht muss Butterfett mit 90 Proc. unlöslicher Fettsäuren vorkommen. 7. Das Auswaschen nicht flüchtiger Säuren ist nicht zu übertreiben und scheinen 3 l Waschwasser für 2·5 g Substanz in dem Maasse am geeignetsten zu sein, als grosse Fehlerquellen durch Nichtauswaschung von flüchtigen Säuren und Entfernung von anderen, in viel Wasser löslichen Producten nicht entstehen können.

Girard untersucht im Pariser Stadtlaboratorium (Documents sur les falsific. des mat. aliment. Al. 238) die Butter nach der Hehner'schen und

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Koettstorfer'schen Methode und erklärt als gefälscht diejenige Waare, bei welcher er weniger als 221·5 mg Kaliumhydrat für 1 g Butterfett braucht. Der Gehalt an unlöslichen Fettsäuren des Butterfettes wird zu 86·5—88 Proc. angenommen; die Quantität der beigemengten fremden Fette wird unter Zugrundelegung der Zahl 87·5 für reines Butterfett berechnet. — Magnier de la Source fand den Gehalt des reinen Butterfettes an unlöslichen Fettsäuren unter 87·6 Proc. Ausgenommen war eine Probe mit 89·1 und 89·4 Proc., welche von der Milch von Kühen stammte, die mit Oelkuchen gefüttert waren. Es ist demnach nicht gerechtfertigt, eine Butter mit 88 Proc. unlöslichen Fettsäuren als gefälscht anzusehen. (Rép. Pharm. **88**, 443.) — Mercklng (Journ. de Pharm. d'Alsace, Lorraine d. Pharm. Ztg. 1882, 648) fand in reinen Butterproben nach der Hehner'schen Methode 89·75 Proc. unlöslichen Fettsäure (mit Wachs gewogen). Mit dem Reichert'schen Verfahren ergaben sich bei denselben Butterproben 13·2—13·55 cbcm $^1/_{10}$ Normal-Natronlauge zur Neutralisation der flüchtigen Fettsäuren. Mercklng schlägt vor, die flüchtigen Säuren an Baryt zu binden und nach Entfernung des Ueberschusses des letzteren durch Kohlensäure in der Lösung das Barium als Sulfat zu bestimmen. 5 g reine Butter lieferten 0·2041 g Bariumsulfat. Ziegenbutter enthält nach C. Jehn (Arch. Pharm. (3) **21**, 362) [86·80 —87·56 Proc. unlösliche Fettsäuren, übereinstimmend mit Weiske. Diese Buttersorte unterscheidet sich in dieser Hinsicht nicht von der Kuhbutter. Nach F. Jean (D. Pharm. Ztg. 1882, 648) werden aus der durch Verseifung der Butter erhaltenen Natronseife die festen Fettsäuren durch einen Ueberschuss von Magnesiumsulfat gefällt, wobei die Butyrate, Caprylate etc. in Lösung bleiben. Der Niederschlag wird filtrirt, mit Schwefelsäure zersetzt und die ausgeschiedenen Fettsäuren nach mehrmaligem Waschen mit heissem Wasser bei 110° C. getrocknet.

J. Munier (Zeitschr. f. analyt. Chem. **21**, 394) hat nach der Reichert-schen Methode eine Anzahl von Butteruntersuchungen ausgeführt, welche sich von October 1880 bis Februar 1882 erstreckten. Die Menge der flüchtigen Fettsäuren wurde im October, November, December und Januar am niedrigsten gefunden, im Februar tritt eine Steigerung ein, die bis August anhält, worauf wieder Erniedrigung eintritt. Die niedrigsten Zahlen bleiben beträchtlich hinter den von Reichert festgestellten Grenzen (12—14 cbcm $^1/_{10}$ Normal-Alkali für 2·5 g gute Butter) zurück. Es wurden nur 11—11·9, ja sogar 10—10·5 cbcm Normal-Alkali gebraucht. Eine solche Butter würde, wenn man jene Grenze als die niedrigste festhalten sollte, schon als mit circa 25 Proc. fremden Fetten verfälscht anzusehen sein. Um keinen zu grossen Spielraum für die Verfälschung offen zu lassen, muss man für die verschiedenen Monate verschiedene untere Grenzen ansetzen: August. bis October 11 cbcm, October bis März 10·0 cbcm, von da bis Mai 12·1 cbcm, Mai bis August 12·4 cbcm $^1/_{10}$ Normal-Alkali. Diese Schwankungen scheinen u. a. mit der Lactationsperiode zusammenzuhängen. — Rud. Sandtner (Arch. f. Hygiene **1**, 137) setzt nach der Meissl'schen Methode den unteren Grenzwert

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für die flüchtigen Fettsäuren auf 24 cbcm $^1/_{10}$ Normal-Natronlauge vorläufig fest. Unter 100 untersuchten Fetten waren 55 reine Butterfette, die im Maximum 32·8, im Minimum 24·0 und im Mittel 27·8 cbcm $^1/_{10}$ Normal-Natronlauge erforderten.

Kützing (Ind. Bl. 18) fand beim Schmelzen verdächtiger ranziger Butter ein braunes schwammartiges, aus dünnen seilartig gedrehten Fäden bestehendes Gebilde, welches sich als ein Pilz, den er Hygrococis butyricola Kützing nennt, zu erkennen gab. Der Pilz bewirkt das Verderben der Butter.

Die unter der Bezeichnung Orantia und Carottine in den Handel gebrachten Butterfarben hat Schmitt (Rép. Pharm. d. Pharm. Centr.-H. **24**, 343) untersucht. Orantia ist nichts anderes als eine Lösung von Orlean in Wasser mit einem Zusatz von 25 g trockener Soda auf 1 l. Derselbe Farbstoff liegt auch der Carottine zu Grunde, die ein orangegelbes Oel vorstellt, das sich etwa in der Weise herstellen lässt, dass man 125 g trockenen Orlean bei 100° mit 500 g Oel digerirt.

Nach Fleischmann (Milchztg. **12**, 225, 241) ist unter präservirter Butter solche zu verstehen, welche man für den Export nach überseeischen Plätzen oder für die Verproviantirung von Seeschiffen zum Zwecke einer längeren Aufbewahrung besonders auswählt und in luftdicht zu verschliessende Weissblechgefässe verpackt. Es eignet sich besonders feste und klare Butter dazu; ein Zusatz zu guter Butter von 4—5 Proc. ihres Gewichtes an gutem Buttersalze genügt, um sie auf Jahre hinaus zu conserviren. Die mittlere chemische Zusammensetzung mehrerer Proben zeigt: Wasser 10·77 Proc., Butterfett 85·19 Proc., Proteïnstoffe 0·614 Proc., stickstofffreie lösliche organische Substanz 0·61, Asche und Kochsalz 2·801 Proc. — Die Haltbarkeit der Butter ist nicht abhängig von der absoluten Menge an Proteïnstoffen und der stickstofffreien organischen Substanz, sondern davon, ob diese Stoffe noch völlig intakt oder schon in Zersetzung begriffen sind. Conservirende Zusätze sind auszuschliessen.

Ueber „Butterconservirung“ hat W. Hagemann (Landw. Vers. Stat. **28**, 201 und Inaug. Dissertat.) eingehende Untersuchungen angestellt. Das Ranzigwerden der Butter wird in erster Linie durch den Gehalt derselben an Milchzucker bedingt, welcher in einer Menge von 0·5—0·6 Proc. darin vorhanden ist. Der Milchzucker zerfällt unter günstigen Bedingungen, welche in der Butter geboten werden, in Milchsäure; diese setzt wiederum die in den kohlenstoffärmeren Glyceridäthern vorhandene Fettsäure in Freiheit. Die Milchsäuregährung und nicht die Buttersäuregährung ist die Ursache des Ranzigwerdens der Butter. Die Sommerbutter wird rascher und stärker ranzig, als die Winterbutter, und es ist danach erklärlich, warum sich die Kunstbutter so gut hält. Für die Conservirung ergiebt sich hiernach, die Glyceride nicht mit Milchsäure in Berührung zu lassen. Die Entfernung derselben, so wie die des Milchzuckers lässt sich zum Teil durch Auswaschen ausführen, wenn das Butteraroma nicht leiden soll. Die Beseitigung der minderen Fettsäuren kann mit Natronlauge geschehen. Da der Zerfall des Milchzuckers in

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Milchsäure durch Bacterien veranlasst wird, so muss die Entwickelung der letzteren verhindert oder mindestens erschwert werden.

Zur Fabrikation der Kunstbutter schreibt Herter (Milchztg. 12, 196): Auf dem neuen Berliner Viehhof in der Renoert'schen Talgschmelze wird Margarin dargestellt, welches behufs Kunstbutterfabrikation nach Holland mit 30—40 ₰ das Pfund verkauft wird. Der Talg wird erst genau sortirt, aller Hammeltalg und ebenso die schlechten Teile vom Rinde werden ausgeschlossen. Dann wird er sauber gewaschen, auf einer grossen mit Dampf getriebenen Häckselmaschine in Stücke geschnitten, zum zweiten Male gewaschen, auf einer Fleischhackmaschine ganz fein zerteilt, nochmals von allem Blut gereinigt und nun in grossen eisernen Reservoiren mit Dampf geschmolzen, wobei das reine Fett in die Höhe steigt, während die Zellgewebteile und alle Unreinigkeiten zu Boden sinken. Der Talg wird durch hinzugelassenes Wasser in die Höhe gehoben und den Pressen zugeführt, während alles übrige aus dem Boden der Blase entfernt und zur künstlichen Düngerfabrikation benutzt wird. Der geschmolzene Talg wird hierauf bei einer genau einzuhaltenden Temperatur, bei der das Stearin schon fest wird, während Margarin und Olein noch flüssig sind, durch Tücher gepresst, worin das Stearin als weisser ziemlich fester Presskuchen zurückbleibt, während die flüssigen Teile in Fässer gelassen und unter dem Namen „Margarin" in den Handel kommen. Es bildet eine fast farblose, sehr reine, ohne jeden üblen Beigeschmack schmeckende Masse, welche in ihrer Consistenz geschmolzener und erkalteter Butter sehr ähnlich ist. In den Wintermonaten werden bis 1000 Ctr. Rohtalg wöchentlich verarbeitet und geben 100 Pfd. Rohtalg meist 80—82 Pfd. Margarin. Die holländischen und Wiener Kunstbutterfabriken durchbuttern dies Product mit Milch, färben, salzen und verkaufen es, nachdem es an seinem Wert 20—25 Proc. verloren hat, überallhin als Spar- und Kunstbutter für 70 ₰ das Pfund.

III. Käse.

Für die Darstellung von Labessenz aus frischem Labmagen giebt F. Nessler (Forsch. a. d. Geb. d. Viehhalt. 1882, Heft 12) folgende Vorschrift. Ein frischer Labmagen, in kleine Stücke zerschnitten, wird zuerst mit 2 l Wasser, in dem 100 g Kochsalz gelöst sind, übergossen, und nach 12 Stunden werden 200 cbcm 90° Alkohol zugesetzt. Das Ganze lässt man unter öfterem Umrühren in einer verschlossenen Flasche 3 Wochen lang stehen. Die Flüssigkeit wird abgegossen und dazu soviel Fliesspapier hinzugefügt, dass dieses eben bedeckt ist. Dadurch scheidet sich der Schleim in wenigen Tagen ab, die Flüssigkeit wird dünnflüssig, und verteilt sich dann viel leichter in der Milch. Nach mehreren Wochen wird die Labessenz in Flaschen abgezogen und aufbewahrt. Eine solche Flüssigkeit, welche in einer stehenden, gut verkorkten Flasche 2 Jahre lang aufbewahrt war, hatte in ihrer Wirksamkeit von 1 : 6 000 zu 1 : 5 450 abgenommen.

Als vegetabilischer Ersatz für Käselab dient nach Hooker in Afgha-

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nistan und Belutschistan die Frucht einer dort einheimischen *Puneer-bund* (Käsemacher) genannten Solanee *Puneeria coagulans*. (Arch. d. Pharm. aus The Pharm. Journ. and Transact. (3) No. 656, 588.)

U. Weidemann (Landw. Jahrb. **11**, Heft 4 d. Forsch. a. d. Geb. d. Viehhalt. etc. 1883, Heft 13, 216) konnte im Emmenthaler Käse qualitativ Cholesterin (0·24 Proc. in frischem, 0·32 Proc. in reifem Käse) und Leucin nachweisen. Tyrosinreaction wurde mit Millon's Reagens erhalten. Als charakteristischen Bestandteil fand Verfasser eine Substanz, die er Caseo-Glutin nennt.

N. Gerber (Milchztg. 1882, 114; Dingl. pol. Journ. **247**, 474) teilt mit, dass die Fabrikation von künstlichem Fettkäse in den Vereinigten Staaten sehr grosse Ausdehnung gewonnen hat, so dass schon erhebliche Mengen nach Europa ausgeführt werden. In New-York bestehen 50 Fabriken von Kunstkäse, die nach den vereinigten Patenten von Cooley, Freemann, Larabee und Jocelyn arbeiten. Je 1 000 l Magermilch werden mit 100 l Buttermilch bei 31—32° C. und je 0·5 kg zweier patentirter Extracte, Antistaffing und Antimottling genannt, versetzt und 10—12 Minuten gerührt. Inzwischen lässt man auf je 2 Tle. Magermilch von 55° C. 1 Tl. geschmolzenes Fett in eine kleine 3 000—4 000 Umdrehungen machende Schleuder, deren Oberfläche feine Löcher besitzt. Man erhält eine Fettemulsion, welche in einer Käsewanne auf 32—33° gebracht, mit Labextract und Kochsalz versetzt und bei der man schliesslich bei 35—40° den Käseprocess vor sich gehen lässt. Die Käsemasse wird von Molke befreit und gepresst. Man erhält 20—30 kg schwere Käselaibe. Nach 4 Wochen ist der Käse marktfähig. — P. Vieth (Ebenda. 519 bezw. 475) fand in 2 Proben dieser Kunstkäse

	Schmalzkäse	Oleomargarinkäse
Wasser	38·26 Proc.	37·99 Proc.
Fett (Aetherextract) . . .	21·07 „	23·70 „
Casein u. dgl.	35·55 „	34·65 „
Asche	5·12 „	3·66 „

Das mit Aether ausgezogene Fett bestand beim Schmalzkäse aus 63 Proc. Butter und 37 Proc. fremdem Fett, das des anderen Käses aus 46 Proc. Butter und 54 Proc. fremdem Fett. — Eine Beschreibung der Darstellung des amerikanischen Kunstkäses giebt Ad. Langfurth (Repert. d. anal. Chem. **3**, 88). Die Analyse des Käses ergab 30·2 Proc. Wasser, 20·8 Proc. Fett, 4·4 Proc. Salze und 44·6 Proc. Casein, Milchzucker etc.

IV. Fleischwaaren.

St. Martin (Bull. commerc. de l'Union pharmac. Nr. 5, 82, 229) giebt eine Vorschrift zur Bereitung von Fleischsaft, nach der es möglich ist, aus dem rohen Fleische allen Saft zu gewinnen. Das feinzerteilte Rindfleisch wird mit Fleischbrühe in einem Mörser zu einem möglichst feinem Teige zerstossen, durch Leinwand gepresst, und die Flüssigkeit wird eingedampft. Durch Zusatz von Zuckersyrup kann man den Fleischsaft in einen Syrup verwandeln, der sich längere Zeit aufbewahren lässt.

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Vom Argentinischen Fleischextract von St. Elena veröffentlicht Niederstadt seine Analysen und vergleicht sie mit denjenigen von Fresenius und Bischoff (Arch. Pharm. (3) **20**, 580).

In 100 Tln. sind enthalten:	Fresenius.	Bischoff.	Niederstadt.
Organische Substanz	61·13	62·42	66·07
Asche	20·99	20·69	20·08
Wassergehalt	17·88	16·89	13·85
Stickstoff	9·55	8·30	9·02
Fett	unwesentlich	unwesentlich	unwesentlich
Leim	do.	do.	do.
In Alkohol löslich	68·43	72·98	69·60
In Alkohol unlöslich	—	—	16·55

Auf der Ausstellung für Hygiene in Berlin etc. befand sich ein flüssiges Fleischextract „Cibils“. Dasselbe, ebenfalls amerikanisches Fabrikat, wird in Flaschen zu 2 ℳ verkauft; 2 Kaffelöffel davon in einer Tasse siedenden Wassers aufgelöst geben eine klare wohlschmeckende Bouillon. — J. A. Hilger fand das spec. Gewicht von Cibils zu 1·21, Trockenrückstand 35·04 Proc., Asche 19·44 Proc., organische Bestandteile 16·00 Proc., Fett 0·37 Proc., Stickstoff (in Form löslicher Albuminate, Kreatinin etc.) 2·10 Proc., Chlor als Kochsalz, Chlorkalium 9·36 Proc. Die Analyse von Frühling und Schulz ergab in 100 Tln. des Extractes 16·16 Proc. organische Stoffe mit 2·54 Proc. Stickstoff, 4·05 Proc. Phosphate und Kalisalze, 15·00 Proc. Kochsalz, 64·79 Proc. Wasser. — 100 Tle. Trockensubstanz enthalten 45·90 Proc. organische Stoffe und 7·21 Proc. Stickstoff.

Ueber die Fabrikation des Fleischpulvers berichtet Otto Leonhardt (Dingl. polyt. Journ. **247**, 334). Das Fleisch wird sofort nach dem Schlachten von allem anhaftenden Fett, Knochen etc. befreit, zerschnitten und auf Drahthorden in gleichmässig dicker Schicht von 1·5—2 cm Dicke ausgebreitet. Bei den einfacheren Verfahren beginnt man mit einer Trockentemperatur von 35° und steigert sie auf etwa 60°, bei welcher Temperatur alles im Fleisch enthaltene Wasser bis auf etwa 6—7° verdampft werden muss. Um nun schliesslich das Fleisch in eine harte feste Masse, die man zermahlen kann, zu verwandeln, wird die Hitze verstärkt; dieselbe darf 95° nicht überschreiten. Bei diesem Verfahren verhindert man ein Gerinnen des Albumins. Der von Meinert verwendete Zusatz von Kochsalz muss als zweckmässig anerkannt werden. Die Actiengesellschaft Carne pura verfährt wesentlich in ähnlicher Weise. Es werden die Knochen, Sehnen etc. ausgesondert, um etwa an denselben noch haftende Nährstoffe durch Auskochen auszuziehen und zu wertvollen Brühen einzudicken. Verfasser beschreibt einen für den in Rede stehenden Zweck sehr brauchbaren Trockenapparat, den er auch zum Trocknen chemischer Präparate empfehlen kann. — Das Patent-Fleischpulver „Carne pura“ (D. P. 8599) enthält nach einer Analyse Stutzer's in Bonn 72·23 Proc. stickstoffhaltige Substanz, 5·07 Proc. Fett,

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8·52 Proc. Wasser und 14·18 Proc. Salze. Von der stickstoffhaltigen Substanz sind unverdaulich 1·11 Proc., verdaulich 71·12 Proc.; dieselbe enthält 11·579 Proc. Stickstoff. In der Asche ist 1·567 Proc. Phosphorsäure enthalten.

Dujardin-Beaumetz (Rép. de Pharm. **10**, 265) ersetzt in dem von Dr. Debove angegebenen Fleischpulver das Rindfleisch durch das billigere Pferdefleisch und versetzt es mit einem nahrhaften Mehle, insbesondere mit Linsenmehl. — R. Reber (Pharm. Centralh. **24**, 232) beschreibt die Anwendung eines pulverisirten Fleischmehles für die Ernährung Kranker (an Auszehrung Leidender) und giebt eine Vorschrift zur Herstellung von pulverisirtem Fleisch. — Deutsches und amerikanisches Fleischmehl, welches zur Hundekuchenbäckerei Verwendung findet, enthält nach C. Arnold (Rep. d. anal. Chem. **8**, 355) in 100 Tle. Trockensubstanz:

	Amerikanisches Fleischmehl	Deutsches Fleischmehl
Fett	14·15—17·50 Proc.	15·55—16·00 Proc.
Asche	2·21— 4·44 „	5·80—16·40 „
Stickstoffsubstanz(N×0·25)	77·00—81·13 „	77·20—78·40 „
Stickstofffreie Substanz .	0·52— 2·35 „	0·05— 0·40 „

An J. Loos ist das D. P. 22305 für ein Verfahren zum Pökeln von Schweinefleisch erteilt worden. Das Schweinefleisch wird während einiger Stunden der Einwirkung eines mit Salzsäure angesäuerten und auf etwa 80—96° C. erhitzten Salzbades ausgesetzt. Die Fleischteile werden darauf in auf 60—70° erwärmter Luft getrocknet.

Bei der Conservirung des Fleisches durch Kälte nach dem System Bade (Journ. Pharm. Chim. **8**, 38 u. Chem. Centralbl. **14**, 557) befindet sich das Fleisch in geschlossenen Räumen, welche continuirlich von einem Strome kühler Luft durchflossen werden. Die Wände der Räume sind dreifach mit 3 cm Zwischenraum und bestehen aus Holz, welches auf beiden Seiten mit Teerpapier beklebt ist. Sie sind für Luft undurchdringlich. Daneben befindet sich ein Eisbehälter mit 50 Tonnen Eis, welches für 60 Tonnen Fleisch ausreicht. Ein Ventilator in der Kammer wird durch eine kleine Dampfmaschine bewegt, so dass die Luft des Eisbehälters durch den Ventilator in die Kammer geführt wird, deren Temperatur + 2—3° C. beträgt. Bei dem System Cravens sind die inneren Wände des Fleischbehälters mit dicht nebeneinander liegenden Röhren ausgekleidet, in denen eine Kältemischung aus Kochsalz und Schnee circulirt. Das Reservoir dafür wird mit 80 Scheffeln Salz und 40 Tonnen Eis gefüllt, welche Menge auf 13—14 Tage ausreicht. Die Röhren kühlen die Luft noch auf eine Entfernung von 6 m genügend ab. Auch hier erreicht die Temperatur + 2—3° C. Beide Vorrichtungen sind auf den Dampfern vorhanden, welche die Einfuhr frischen Fleisches aus den Ver. Staaten nach England vermitteln. Der Kälteapparat von Dell Colman, der mit comprimirter Luft arbeitet, wird ebenfalls für diesen Zweck benützt. — Kolbe (Journ. f. pract. Chem. **26**, 249) teilt über die antiseptischen Eigenschaften der Kohlensäure mit, dass Ochsenfleisch bei fünfwöchentlichem Verweilen in Kohlensäure keine Spur von

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Fäulnis zeigte; doch war die Fleischbrühe nicht mehr so wohlschmeckend, als frische; bei dreiwöchentlichem Verweilen in Kohlensäure war das Fleisch und die davon bereitete Brühe von noch sehr gutem Geschmack. Hammel- und Kalbfleisch, Wild, Geflügel, Fische und Obst widerstanden der Fäulnis in einer Atmosphäre von Kohlensäure nur kurze Zeit. — In einem Gemisch von Kohlenoxyd und Kohlensäure bleibt Ochsenfleisch gleichfalls wochenlang gut. An der Aussenfläche zeigten sich einige Schimmelrasen. Verf. beschreibt einen Apparat zum Conserviren des Fleisches mittels Kohlensäure. — Mathieu Closset (D. P. 23317) bringt das zu conservirende Fleisch in eine Büchse, füllt sie mit einer antiseptischen Flüssigkeit z. B. Alkohol, Weinessig etc. und verschliesst sie darauf. Die Büchse wird unter Wasser, indem der Hals derselben nach unten gerichtet ist, geöffnet und die betreffende Flüssigkeit durch ein Gas verdrängt, in dem vorher alle Gährungskeime getödtet sind, z. B. durch Luft, die durch heisse mit Holzkohle, Eisen- oder Kupferspäne gefüllte Röhren geleitet ist. Die jetzt nur noch mit dem zu conservirenden Fleisch und mit vor Fäulnis schützendem Gase gefüllte Büchse wird sodann verschlossen. — Das von Fil. Arthmmi (Engl. Pat. 1127 vom 8. März 1882) angegebene antiseptische Mittel zur Conservirung von Fleisch besteht aus einer Lösung von 1 Gewtl. Aepfelsäure und 11 Gewtln. Borsäure in Wasser. — E. Pavesi (Giorn. Farm. Chim. **31**, 529) fand, dass in sehr stark verdünntem Königswasser sich das Fleich (in hölzernen Bottichen) jahrelang erhält und an Wohlgeschmack nicht verliert. Trocknet man das Fleisch bei 15—20°, so erleidet es nur eine Verminderung seines Volumens und nimmt eine braune Farbe an; beim Waschen mit Wasser gewinnt es seine Farbe und Weichheit wieder.

Zur Bestimmung des Stärkemehles in Wurst giebt Carl Arthor (Repert. d. anal. Chem **2**, 356) das folgende Verfahren an: 10 g der gut zerkleinerten Wurst, die vorher mit Aether entfettet wurde, werden längere Zeit mit Wasser gekocht, der auf 70° C. erkalteten Flüssigkeit etwas Diastase zugesetzt und eine Stunde bei dieser Temperatur digerirt. Man kocht jetzt einmal auf, filtrirt, wäscht gut aus, dampft das Filtrat auf 95 cbcm ein, setzt 5 cbcm Salzsäure von 1·124 spec. Gew. zu und erhitzt in einer Druckflasche im Kochsalzbade drei Stunden lang. Die Flüssigkeit wird jetzt mit Fehling'scher Lösung titrirt. Man erhält die Menge der vorhandenen Stärke, wenn man die Menge des gefundenen Traubenzuckers mit 0·9 multiplicirt.

O. Atwater (Ber. d. Chem. Ges. **16**, 1839) teilt die Resultate der Analysen von 118 Proben von Fischfleisch mit.

V. Fette und Oele für Speisezwecke.

Nach F. H. Cochran in Everett (D. P. 22638) werden für Speisezwecke bestimmte Fette oder Oele auf 65 bis 95° erwärmt und unter Umrühren mit gepulverter Ulmenrinde versetzt. Dieselbe soll den unangenehmen Geruch der Fette und Oele beseitigen und den daraus hergestellten Fettmischungen einen angenehmeren Geruch verleihen.

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8·52 Proc. Wasser und 14·18 Proc. Salze. Von der stickstoffhaltigen Substanz sind unverdaulich 1·11 Proc., verdaulich 71·12 Proc. entsprechend 11·579 Proc. Stickstoff. In der Asche ist 1·567 Proc. Phosphorsäure enthalten.

Dujardin-Beaumetz (Rép. de Pharm. **10**, ...) empfiehlt nach Dr. Debove angegebenen Fleischpulver das Bd... Pferdefleisch und versetzt es mit einem nahrh... Linsenmehl. — R. Reber (Pharm. Cent... Anwendung eines pulverisirten Fleischmeh... Auszehrung Leidender) und giebt eine V... sirtem Fleisch. — Deutsches und ... welches zur Hundekuchenbäckerei Ver... (Rep. d. anal. Chem. **3**, 355) in 1...

	Ameri...
Fett	14
Asche	
Stickstoffsubstanz (N×0·25)	
Stickstofffreie Substanz .	

An J. Loos ist das ... Schweinefleisch erteil... Stunden der Einwirkur... 80—96° C. erhitzten ... in auf 60—70° erw...

Bei der Cod... System Bade (Jou... findet sich das Fl... Strome kühler ... mit 3 cm Zw... mit Teerpap... befindet s... Fleisch ... Dampfm... lator ... Bei ... dic... m...

...ta (Dingl. pol. Journ. **249**, 270) hat eine Reihe von ... und Pflanzenreichs nach der Methode von Körnsroper[1], ... giebt u. a. folgende Zahlen an:

	Dichte bei 15°	1 g braucht zur Verseifung mg KHO		Schmelz- und Erstarrungspunkt	
		Fett	Fettsäure	Fett	Fettsäure
...kernöl	0·9191	192·9	—	—	—
...mandelöl, fettes . .	0·9196	194·5	—	—	—
...öl aus süssen ...	0·9186	194·7	—	—	—
...deln		196·1	—	—	—
...öl	0·9149	191·7	203·0	—	23·6 u. 19·3°
...samenöl I	0·9613	181·0	—	—	—
„ II	0·9736	181·5	—	—	—
...öl I	—	202·0	206·5	30·8 u. 22·6°	47·75 u. 43·00°
„ II	—	202·5	207·3	28·5 „ 21·0	47·75 „ 42·5
...nussöl, altes I . .	—	268·4	275·5	24·1 „ 19·5	24·65 „ 21·85
„ „ ...ches „ . .	—	258·3	275·2	23·5 „ 15·7	24·7 „ 19·00
„ „ ...deg' „ . .	—	257·3	277·2	—	—
...öl	—	192·6	—	—	—

[1] Dingl. chem. Jahrb. 3, S. 283.

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Dichte bei 15°	1 g braucht zur Verseifung mg KHO		Schmelz- und Erstarrungspunkt	
	Fett	Fettsäure	Fett	Fettsäure
195·5	—		—	—
196·5	—		—	—
6·6	—		—	—
?	—		—	—
	—		—	—
	—		—	—
			—	—

...ahrungsmittel.

...ann. Land- u. Forstw. Vereinsbl. 1883) ...ter- und in den guten Sommer-Weizen- ...er vorhanden. Die meisten ungarischen und ...halten ebensoviel, dagegen einige aus Südrussland ..., *Ghirka*) bis 45 Proc. Letztere Weizenarten dienen ...ermischen mit dem kleberarmen englischen Weizen. — ...rch. f. Hygiene **1**, 143) schreibt über das Vorkommen blauge- ...Zelleninhaltes in der Kleberschicht von Roggenkörnern.

Die anregenden Eigenschaften des Hafers führt A. Sanson (Journ. de l'Anat. et Physiol. **19**, 113) auf ein amorphes Alkaloid $C^{36}H^{21}NO^{18}$, das Avenin, welches in Alkohol löslich ist, zurück. Es wirkt hauptsächlich auf die motorischen Ganglien. Das Alkaloid ist vom Verfasser aus dem Pericarpium aller cultivirten Hafersorten isolirt worden. Der weisse Hafer wirkt anregender als der schwarze. Beim Mahlen ändert sich, wie es scheint, dieser Körper, die anregende Wirkung ist schneller, aber weniger stark und anhaltend.

2. **Mehl.** A. Tomaschek (Pharm. Centr.-H. **23**, 406) macht für die mikroskopische Mehluntersuchung auf die sog. „Leitfragmente" aufmerksam, d. h. Structur-Elemente, welche ihre ursprüngliche Beschaffenheit auch in der Rohwaare festhalten. Für das Gerstenmehl z. B. sind als Leitfragmente die der Spelze angehörigen, dicht wellenrandigen zierlichen Tafelzellen anzusehen. Für das Weizenmehl ist das betreffende Leitfragment eine in den stärkeführenden Endospermzellen auftretende Proteinsubstanz, die mit Cochenillepulver eine prächtige carminrote Färbung annimmt und von den ungefärbt bleibenden Stärkekörnern unterschieden werden kann. — Eine mikroskopische Unterscheidung von Weizen- und Roggenmehl basirt Wittmack darauf, dass das Weizenkorn an der Spitze eine grosse Zahl aufrechter, ziemlich langer Haare besitzt, während diese beim Roggenkorn geringer und viel kürzer sind. Trotz aller Vorsichtsmaassregeln beim Mahlprocess gelangen einige dieser Haare oder Teile davon ins Mehl und geben dieselben dann ganz gute Unterscheidungsmerkmale ab. Es beträgt nämlich:

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	beim Weizen	beim Roggen
	Mikromillimeter	
die Länge der Haare	142—742	50—420
der Durchmesser der grössten Haare . . .	15—21	9—17
derselbe an der zwiebelförmigen Basis . . .	—28	—23
der Durchmesser der kleinsten	9—10	—8
derselbe an der Basis	—14	11—14

Wichtiger ist die Dicke der Wände der Haare:	beim Weizen	beim Roggen
	Mikromillimeter	
durchschnittlich	6—7	3—4
das Lumen ist weit	1·4—2, selten bis 5	—7

Bei der Prüfung verkleistert man entweder auf dem Objectträger oder verkleistert resp. verzuckert grössere Mehlmengen, lässt absetzen und untersucht den Bodensatz. (Pharm. Centr.-H. **23**, 407.) — Zur Unterscheidung von Roggen- und Weizenmehl empfiehlt Kjärsgr, das Mehl mit der von Ritthausen empfohlenen $^1/_{1000}$ Kalilösung zu behandeln und 24 Stunden stehen zu lassen. Die Flüssigkeit wird abgehoben, das Mehl mit Wasser geschüttelt und zum Absetzen bei Seite gestellt. Zu unterst finden sich dann die grösseren Stärkekörner, darüber die Schalenteile und kleine Stärkekörner, ganz zu oberst eine Schicht kleinster Stärkekörner. Durch fortgesetztes sorgfältiges Schlämmen lassen sich dann die Schalenteile, durch welche man die beiden Mehlsorten unterscheiden kann, fast ganz isoliren. (Arch. d. Pharm. a. Meddeleser fra den Bot. Forening i Kjöbenhavn No. 1 1882, 9—13.)

Nach Aug. Lehn (Pharm. Centr.-H. **24**, 130) werden zum Nachweis von Reismehl im Buchweizenmehle etwa 10 Mehl mit 2 conc. Kalilauge und Wasser bis zur Kleisterbildung erwärmt und dann mit Salzsäure versetzt. Bei Reismehl wird der Kleister gelblich und mit Salzsäure versetzt weiss; bei Buchweizen mehr dunkelgrün und mit Salzsäure rot. Bei der Mischung beider wird der Kleister stellenweise grün und mit Salzsäure fleischfarbig. Die Methode des Auswaschens bezw. Ausknetens giebt gleichfalls gute Resultate; hier bleibt bei Reiszusatz ein deutlich weisser Rückstand. Ebenso gelingt der Nachweis mit Spiritus und Salzsäure. Bei Reismehl bleibt die Flüssigkeit farblos, bei Buchweizenmehl wird sie bald bräunlich, genau so, wie die Farbe des verwendeten geschälten Buchweizens. Die Quellung der Stärkekörner in Natronlauge benutzt Symens (Pharm. Centr.-H. **24**, 150) als Mittel zu ihrer Unterscheidung.

Lester Reed (Chem. News 48. 63) gründet eine Methode zur annähernden Bestimmung des Klebers im Mehle darauf, dass Salpetersäure mit den Eiweisskörpern eine gelbe Nitroverbindung liefert. 0·5 *g* des Mehles werden in eine Probirröhre gebracht, welche von unten bis zu ihrer halben Höhe in vier gleiche Teile geteilt ist, dann wird bis zum 4. Teilstrich Wasser hinzugefügt und geschüttelt. Der Inhalt wird in eine trockene Röhre gegossen, die erste Röhre gut gereinigt und dann $^1/_4$ der wässrigen Mischung hineingebracht, worauf man bis zum Teilstriche 3 starke

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Salpetersäure nachgiesst. Nach genau 5 Minuten wird filtrirt. Zum Vergleich wird eine Probe eines anderen Mehles von bekanntem Klebergehalt in gleicher Weise behandelt und die beiden Lösungen colorimetrisch verglichen. — Balland (Compt rend. **97**, 497) bestimmt den Kleber im Mehle auf folgende Weise: 50 g Mehl werden mit 20—25 g Wasser zu einem Teig angerührt, den man 25 Minuten lang stehen lässt, um ihn darauf in 2 gleiche Teile zu teilen. In dem einen Teile wäscht man die Stärke sofort aus, in dem anderen nach Verlauf einer Stunde. Man presst den Kleber stark mit der Hand aus, bis das Waschwasser klar abläuft und wiegt ihn feucht, darauf wird er nochmals 5 Minuten gewaschen und wieder gewogen. Aus den 4 Wägungen nimmt man das Mittel. — Von Kleber aus neuem Mehl sind in 24 Stunden 10 Proc., aus altem Mehl 20 Proc. in Wasser löslich. Nach dem Trocknen ist der Kleber im Stande, den vollen Wassergehalt wieder aufzunehmen.

Ueber Veränderungen, denen das Mehl beim Altern unterliegt, hat Balland (Compt. rend. **97**, 346) Untersuchungen angestellt.

A. Pohl (Ber. Chem. Ges. **16**, 1975) fand bei Untersuchungen über die Fäulnis des Roggenmehles unter Einwirkung von Mutterkorn: 1. Mutterkorn, wie auch Schimmelbildung rufen unter gewissen Bedingungen peptische Wirkung auf die Eiweisskörper des Mehles hervor und begünstigen den Fäulniszerfall derselben. 2. Der Fäulniszerfall der Eiweisskörper ist direct proportional der Peptonisation derselben. 3. In den ersten Stadien der Fäulnis ist der Zerfall der Eiweisskörper im Mutterkornmehle grösser, als im Mehl mit Schimmel oder reinem Mehl; am grössten ist der Fäulniszerfall bei Einwirkung von peptischem Ferment; nach einiger Zeit steigert sich die Differenz in den Versuchsreihen und die Fäulniseinwirkung des Mutterkorns nimmt relativ schnell zu. 4. Nach lang andauernder Fäulnis verringert sich allmählig die Differenz in der Fäulniseinwirkung der verschiedenen Beimischungen zum Mehl. — Die wesentlichsten Momente, welche die Bildung von Fäulnisalkaloiden in mutterkornhaltigem Roggenmehl bedingen, sind somit folgende: 1. Verwandlung der Stärke in Glycose, 2. Gährung der Glycose unter Milchsäurebildung, 3. Peptonisation der Eiweisskörper durch peptische Einwirkung des Myceliums von Claviceps purpurea in Gegenwart von Milchsäure, 4. Uebergang des Peptons zu Ptomopepton und Zerfall unter Bildung von Fäulnisalkaloiden.

Um geringe Mengen Mutterkorn im Mehl (aber nicht im Brot) nachzuweisen, wird nach R. Palm (Zeitschr. f. anal. Chem. **22**, 319) das vollständig getrocknete Mehl mit dem 10—15fachen Gewichte Spiritus von 35 bis 40° Tr., dem einige Tropfen Ammoniak zugemischt sind, bei 30—40° C. vollständig extrahirt. Die durch Abpressen erhaltene filtrirte Flüssigkeit wird mit Bleiessig gefällt, der Niederschlag gesammelt, zwischen Fliesspapier abgepresst und mit Kalk gesättigter Boraxlösung (bei gelinder Wärme) digerirt. Die Boraxlösung wird durch den Mutterkornfarbstoff charakteristisch violett gefärbt; ein Zusatz von conc. Schwefelsäure zu der-

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selben bewirkt das Herausfallen des Farbstoffes in dunkelvioletten Flocken. Es lassen sich durch diese Reaction noch 0·05 Proc. und wohl noch weniger Mutterkorn im Mehle erkennen. Dampft man den spirituösen Mehlauszug bis zu einer noch feuchten Masse ein, extrahirt letztere nochmals mit Spiritus von gleicher Stärke und verfährt wie oben, so erhält man noch schärfere Reactionen. Anwendung von Kohle bei den Filtrationen ist zu vermeiden, ebenso lange währendes Abdampfen der Auszüge.

3. Brot. Aus seinen Versuchen über Brotgährung zieht G. Chicandard (Compt. rend. **96,** 1585) folgende Schlüsse: 1. Die Brotgährung besteht nicht in einer Hydratation der Stärke mit darauf folgender Alkoholgährung. 2. Die Gährung wird nicht durch Saccharomyces bewirkt. 3. Ein Teil der unlöslichen Eiweissstoffe des Klebers wird bei der Gährung in lösliche Albumine und dann in Peptone zersetzt. 4. Die Stärke wird nur durch das Backen verändert und zum grossen Teil in lösliche Stärke und etwas Dextrin verwandelt und zwar namentlich an den Stellen, wo das Brot am stärksten erhitzt war. 5. Das Agens der Brotgährung ist eine Bacterie, die sich normal im Teige entwickelt und deren Entwickelung durch die Bierhefe nur beschleunigt wird. Die Analyse des bei der Gährung entwickelten Gases ergab 70 Proc. Kohlensäure, 30 Proc. Wasserstoff und Stickstoff, also eine ähnliche Zusammensetzung, wie die der bei der Fäulnis eiweissartiger Körper entstehenden Gase. — V. Marcano (Compt. rend. **96,** 1733) bestätigt im wesentlichen die vorstehenden Beobachtungen Chicandard's. Jedoch fand Ersterer bei seinen in Venezuela angestellten Versuchen, dass der Teig beim Beginne der Gährung aus viel Erythrodextrin und wenig löslicher Stärke besteht und sich erst beim Backen Achrodextrin bildet. Es ist also der Brotbereitungsprocess eine directe Gährung der Stärke. Die Bacterien greifen die Stärke erst dann an, wenn die Albumine aufgezehrt sind. — Moussette (Ibid. **96,** 1865) teilt mit, dass jedenfalls eine alkoholische Gährung dabei stattfinden müsste, denn er habe in den aus dem Backofen entweichenden Dämpfen 1·06 Vol.-Proc. Alkohol und 0·06 Gew.-Proc. Essigsäure erhalten. — Bourtroux (Ibid. **97,** 116) fand in einem Sauerteig Mykoderma vini, zwei von einander verschiedene Hefearten und einen dem Saccharomyces in der Form ähnlichen Organismus. Es müssen demnach in der Brotgährung mehrere Processe gleichzeitig wirken, die Peptongährung Chicandard's und die alkoholische Gährung. — G. Chicandard (Ibid. **97,** 616) erwidert, dass die Abweichung seiner von Marcano's Ergebnissen von der Verschiedenheit der der Gährung unterworfenen Substanzen herrührt. In Paris setzt man nur Bierhefe, in Venezuela einen Maisdecoct zum Weizenteig.

Alexander Müller sprach auf der Eisenacher Naturforscherversammlung über das Molkenbrot. Bolle, Berlin, hat das Verdienst, zuerst das sog. Molkenbrot angefertigt zu haben. Es wird täglich frisch geliefert in einer etwas gröberen und einer feineren Sorte; zur letzteren setzt man etwas ganze Milch. Die Molken, ca. 3000 l täglich, werden in einem der Firma Hecker & Co. patentirten Vacuumapparate auf etwa $^1/_7$ ihres Volumens

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condensirt und hierauf mit Teig verarbeitet. Auf 1 Pfund Mehl kommen ½ Pfund condensirte Molken. Es kann noch nebenher Magermilch oder Vollmilch zum Teige hinzugesetzt werden, je nachdem man die Eiweissstoffe oder das Fett in dem Gebäck vermehren will. — Senna (Pharm. Centralh. **24**, 250) empfiehlt mit Meerwasser bereitetes Brot gegen Scropheln.

Ernst Möbius in Ebersbach (D. P. 21855) stellt ein Backmittel her aus 1 kg Quark, 0·25 kg feinen Zucker, 0·25 kg feinen Gries, 0·50 kg Milch und 0·035 kg Hefe. Nachdem die Mischung etwa eine Stunde gestanden, wird eine kleine Quantität derselben mit Wasser und Mehl angerührt.

4. Kartoffel. E. Schulze (Landw. Vers.-Stat. **28**, 111) hat aus 100 cbcm Kartoffelsaft 3—4 mg Hypoxanthin als krystallisirtes Hypoxanthinsilbernitrat erhalten. Das Hypoxanthin geht mit den Peptonen in den Niederschlag, welchen Phosphorwolframsäure im Kartoffelsaft erzeugt. In den vorliegenden Fällen wurde es sowohl aus dem vom Eiweiss und den Amidosäuren befreiten Saft nach Diffusion desselben erhalten, als auch direct durch Extrahiren des von Albumin befreiten und eingedampften Saftes mit Alkohol. — Oxalsäure ist nach M. Siewert (Landw. Vers.-Stat. **28**, 263) in einer Menge von etwa 0·017 Proc. in den Kartoffeln enthalten.

VII. Malzextract.

Nach A. Stutzer's*) Methode zur Ermittelung der Eiweissstoffe und durch Vereinigung derselben mit dem von F. Hofmeister angegebenen Peptonbestimmungsverfahren (D. Chem. Ges. **18**, 1753) hat W. Klinkenberg (Repert. d. anal. Chem. **2**, 373) einige der gebräuchlichsten Malzextracte untersucht und festgestellt, dass dieselben noch nicht die Hälfte ihres Stickstoffgehaltes in der Form von Eiweiss und dem ihm in physiologischer Hinsicht nahestehenden Pepton enthalten, sondern, dass der grösste Teil Amiden und ähnlichen Verbindungen angehört. Da es nun bis jetzt üblich war, den Gesamtstickstoff auf Eiweiss zu berechnen, so hat man den Malzextracten eine bedeutend höhere Nährkraft zugeschrieben, als sie in der That besitzen.

	Löfflund's Kinder-Nahrung	Löfflund's Malzextract mit activer Diastase	Löfflund's Malzextract mit activer Diastase und Pepsin	Liebe's Diastase-extract
	Proc.	Proc.	Proc.	Proc.
Wasser	30·75	25·39	23·74	23·82
Asche	1·88	1·01	1·15	1·16
Phosphorsäure	0·519	0·324	0·482	0·466
Gesamt-Stickstoff	0·567	0·584	0·533	0·578
Protein- „	0·195	0·189	0·152	0·145
Pepton- „	0·063	0·053	0·061	0·083
Amid- „	0·309	0·342	0·320	0·350
Eiweiss- „	1·22	1·18	0·95	0·91

*) Techn.-chem. Jahrb. 1883, S. 297.

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	Löfflund's Kinder-Nahrung	Löfflund's Malzextract mit activer Diastase	Löfflund's Malzextract mit activer Diastase und Pepsin	Liebe's Diastase-extract
	Proc.	Proc.	Proc.	Proc.
Peptone	0·39	0·33	0 38	0·52
Kohlehydrate	65·76	72·09	73·78	74·09
100 Tle. Malzextract führen in Zucker über	—	13·4 Tle. Stärke	9·9 Tle. Stärke	2·4 Tle. Stärke
100 Tle. Malzextract lösen	—	—	32·26 Tle. Eiweiss	

VIII. Spirituosen.

Ed. List (Repert. d. anal. Chem. **3**, 34) fand in Rumsorten Ameisensäure, die er als Product der Gährung der Rohzucker-Melasse ansieht.

J. A. Devèze (Engl. Pat. 250 vom 18. Januar 1882) hat einen Apparat zur Prüfung alkoholischer Flüssigkeiten construirt. Aus einem mit Kühler versehenen Destillationsapparat wird eine gewisse Quantität der Flüssigkeit in ein Gefäss überdestillirt, bis das Destillat ein markirtes Volumen erlangt hat. Das Auffangegefäss hängt an dem einen Arm einer empfindlichen Waage, auf deren anderem Arm ein Laufgewicht verschiebbar ist. Die Scala auf diesem Arm giebt den alkoholischen Procentgehalt der Flüssigkeit an. — B. Landmann (Zeitsch. f. anal. Chem. **2**, 394) beschreibt einen Destillationsapparat, der bei thunlichster Raumersparnis mehrere Destillationen neben einander auszuführen gestattet.

Ueber die Untersuchung von Branntweinen schreiben J. Nessler und M. Barth (Zeitschr. f. anal. Chem. **22**, 33). Die Alkoholbestimmung geschieht durch Feststellung des Volumgewichtes entweder durch directe Wägung oder mittels des Rumann'schen Apparates (D. P. 5134 vom 4. Juni 1878). Die freie Säure titrirt man mit einer etwa $^1/_{30}$ normalen alkoholischen Kalilauge (Phenolphtalein als Indicator). — Zur Feststellung des Kupfergehaltes empfiehlt sich entweder das elektrolytische oder colorimetrische Verfahren; letzteres mittels einer stark verdünnten frischen Lösung von gelbem Blutlaugensalz. Diese erzeugt noch in 10 cbcm. einer Flüssigkeit, welche 2 mg Kupfer im Liter enthält, eine schwach rötliche Färbung. Bei alkoholischen Flüssigkeiten soll man von diesem Reagens nur geringe Mengen verwenden, weil sonst ein Opalisiren oder eine Trübung eintritt, welches die Farbenvergleichung stört. Geringere Mengen Kupfer als 2 mg im Liter sind durch eine Guajakharzlösung in Gegenwart von Spuren von Blausäure noch bis zu weniger als 0.5 mg im Liter nachweisbar. Zur Blausäurebestimmung, die gleichfalls colorimetrisch geschehen kann, verwendet man 10 cbcm Kirschwasser und versetzt dasselbe mit einer 0.5 proc. Kupferlösung und 1.5 cbcm frisch bereiteter Guajakholztinctur von weingelber

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Farbe, indem man letztere vorsichtig über das Kirschwasser schichtet und plötzlich durch einmaliges Umkehren des verschlossenen Reagensglases vermischt. Die Intensität der entstandenen Bläuung vergleicht man rasch mit den Färbungen von Vergleichs-Flüssigkeiten, die man sich durch Verdünnung von Kirschlorbeerwasser mit 50proc. Alkohol derart bereitet, dass sie im Liter 2—10 und je nach Bedarf mehr mg Blausäure enthalten. Letztere stellt man vorher im Kirschlorbeerwasser mittels des Liebig'schen Verfahrens fest. — Verff. besprechen weiter die Methoden zur Prüfung der Branntweine auf Fuselöl und auf die riechenden und schmeckenden von den Früchten stammenden Stoffe.*)

Unter der Sammlung von Nahrungs- und Genussmitteln nebst deren Verfälschungen und Verunreinigungen, welche von dem Museum der landwirtschaftlichen Hochschule Berlin und der Versuchsstation Münster in W. (Professor Wittmack bez. Koenig) auf der Hygiene-Ausstellung ausgestellt waren, befanden sich auch Surrogate für Spirituosen. Beigefügt waren die Vorschriften zur Herstellung dieser Art Getränke. So z. B. lautete die Vorschrift zur Anfertigung von Hefenbranntwein, Slibowitz-, Trester- und Zwetschenbranntwein: Man nimmt zu 400 l 42-proc. Branntwein (aus Sprit und Wasser) 1 kg der betreffenden Essenzen, mischt durcheinander und lässt einige Zeit ablagern, wodurch man eine der aus den Früchten selbst gebrannten vollkommen ähnlichen Façonwaare erhält, welche sich ganz besonders zum Verschneiden der ächten Branntweine eignet. Aehnlich war eine Vorschrift für Herstellung von Cognac, die einem Surrogat „Superfeinstes höchst rectificirtes Weinbeer- oder Cognac-Oel" bei gegeben war.

IX. Kaffee.

Ueber die physiologische Wirkung des Kaffees haben J. A. Fort (Compt. rend. **96**, 793) und Guimares (Journ. Pharm. Chim. (5) **7**, 413; Chem. Centrbl. (3) **14**, 564) eingehende Untersuchungen angestellt.

Aus dem Umstande, dass grüner Kaffee Wasser intensiv färbt, wird nicht selten auf eine künstliche Färbung desselben geschlossen. Nach J. Nessler (Chem. Ztg. **7**, 372) färbt sich kalkhaltiges oder alkalihaltiges Wasser, in dem grüne Kaffeebohnen sich befinden, grün, durch Bildung von Viridinsäure, während bei destillirtem Wasser diese Färbung nicht auftritt.

F. T. Hanausek (Pharm. Centrh. **24**, 355) giebt eine genaue Beschreibung des mikroskopischen Bildes des Sacca- oder Sultan-Kaffees, arabisch: Kischer, welcher aus den bei der Gewinnung der Kaffeebohnen abfallenden Frucht- und Samenhülsen bereitet wird. Das Surrogat enthält Kaffein. Beim Rösten desselben tritt der charakteristische Kaffeegeruch auf.

Von der landwirtschaftlichen Gesellschaft zu Pernambuco erhielten Riche & Rémont (Journ. Pharm. Chim. d. Pharm. Centrh. **24**, 126) ein Samenmuster einer in Brasilien in grossen Massen auftretenden Papilionacee

*) Techn.-chem. Jahrb. 1883, S. 292.

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der Gattung *Canavalia* zur Aeusserung darüber, ob die Bohne als Ersatz oder Surrogat des Kaffees dienen kann. Da die Bohne kein Kaffeïn enthielt, haben die Obigen die Frage verneint.

Das auf der Hygiene-Ausstellung ausgestellte Behr'sche Kaffeesurrogat, verbessert von C. Hennig, wird aus Weizenkleie, Mais und Gerstengraupen bereitet und enthält nach Fresenius: In Wasser lösliche Bestandteile 61·33 Proc., davon Asche (mit 1·31 Proc. Phosphorsäure) 3·37 Proc., organische Substanzen 57·96 Proc.; und in Wasser unlösliche Bestandteile 36·45 Proc., davon Asche 1·17 Proc., organische Substanzen 35·28 Proc.

Cellulose	9·78 Proc.	Sonstige stickstofffreie Stoffe	9·83 Proc.
Stärke	8·34 „	Fett	3·91 „
Dextrin (incl. Zucker) .	49·51 „	Asche	4·54 „
Stickstoffsubstanz . . .	11·87 „	Feuchtigkeit	2·22 „

Nach demselben enthält der Behr'sche Malto-Kaffee (ebenfalls aus Getreidesorten unter Zusatz schwach geröstetem Malz bereitet: 64·25 Proc. in siedendem Wasser lösliche Stoffe, darunter 4·22 Proc. Eiweissstoffe, 50·19 Proc. Dextrin, 7·57 Proc. in 92 proc. Alkohol lösliche Extractivstoffe, 2·27 Proc. Asche (mit 0·54 Proc. Phosphorsäure); ferner 35·40 Proc. in siedendem Wasser Unlösliches, 0·35 Proc. Feuchtigkeit. (Ausstellungs-Drucksache.)

Nach Frederick Pool (D. P. 18081 v. 10 Sept. 1881) werden zur Herstellung von Feigenkaffee getrocknete Feigen zu Blöcken geformt, diese in Scheiben geschnitten und in eine heizbare Siebtrommel gebracht, wo sie durch Schläger gegen die halbkugeligen Böden derselben bewegt werden und dadurch ihre Feuchtigkeit durch die Siebwandungen besser abgeben können. Aus dieser Siebtrommel gelangen die nun gedörrten Feigen in die Rösttrommel, welche lose auf einer Welle sitzt und sich leicht von dem Ständer, auf dem sie ruht, abnehmen lässt.

X. Thee.

Bauer (Rundschau 1883, 607) bestimmt den Gerbstoff im Thee, indem er 2—5 g desselben 3 mal $^1/_2$—$^3/_4$ Stunden mit 200—350 cbcm Wasser auskocht, 20—25 cbcm einer Lösung von Kupferacetat (1 in 20—25 Wasser) hinzufügt, filtrirt und den Niederschlag unter Schwefelzusatz im Rose'schen Tiegel im Wasserstoffstrome glüht. 1 g Schwefelkupfer entsprechen 1·306 g Gerbsäure. Catechu entdeckt man, wenn man 1 g Thee mit 50—75 cbcm Wasser kocht, filtrirt, das Filtrat mit Bleiacetat kocht und dem neuen Filtrat Höllenstein zusetzt. Catechu bei Thee bewirkt die Entstehung eines braunen Niederschlages. Ein Theeauszug, der mit Schwefelsäure hellgrau wird, deutet Campeche im Thee an. Eisensalze entdeckt man in der Asche (normal 0·03 bis 0·12 Proc. Fe^2O^3). Verfälschung mit Weidenrose weist man nach, dass man einem Theeaufguss die doppelte Menge 90—95 proc. Alkohol zufügt; bei echtem Thee bleibt die Mischung klar, im anderen Falle entsteht eine schleimige Ausscheidung.

Königsberger Thee-Compagnie, Actiengesellschaft in Berlin. Thee-

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conserve. (D. P. 19349 vom 10. Januar 1882.) 100 g gemahlener Zucker werden unter Zusatz von 10 g Stärkezucker mit soviel Wasser, wie zur Lösung des Zuckers erforderlich, gekocht, bis die Masse dickflüssig, aber noch durchsichtig ist. Nach der Abkühlung derselben werden 50 g Thee, die zuvor mit 50 g trockenem Zucker zusammengemengt waren, zugesetzt. Die plastische Masse wird in metallene Formen gepresst, und bildet erhärtet die Theeconserve.

XI. Cacao und Chocolade.

Das Vorkommen von Caffeïn im Cacao hat Ernst Schmidt (Lieb. Annal. **297**, 306) beobachtet. Bei der Theobromindarstellung aus Cacao hat Verf. in den letzten Mutterlaugen das Caffeïn durch Lösen in kaltem Benzol vom Theobromin getrennt und durch Umkrystallisiren aus Wasser gereinigt.

Ueber die Zusammensetzung des Cacaoöles hat M. C. Traub (Arch. Pharm. **21**, 19) Untersuchungen angestellt. Verfasser hat aus der Seife des Cacaoöles durch fractionirte Fällung mittels Magnesiaacetats eine Säure von den Eigenschaften und der Formel der Aractinsäure isolirt.

Ueber den Kupfergehalt des Cacao und der Chocolade hat Galippe (Journ. des conn. méd.; Pharm. Centralh. **24**, 268) bestimmt, nachdem schon 1871 Duclaux gezeigt hat, ebenso auch Skalweit (Wider die Nahrungsmittelfälscher 1878, Februar), dass sämtliche Cacaosorten in natürlichem Zustande Kupfer als normalen Bestandteil enthalten.

Ausführliche Angaben über die Zusammensetzung des Cacao und über den Gang der Untersuchung desselben, sowie der Chocolade liefert die Pharm. Centralh. **28**, 546, 555; desgleichen beschreibt F. Elsner (Chem. Ztg. **7**, 1209) und Boussingault (Anal. Chim. Phys. 1883, 433) die Analyse von Cacao und Chocolade (Vgl. auch Chem. Ztg. **7**, 902).

L. Legler (X. u. XI. Jahresber. d. Königl. Chem. Centralstelle f. öffentl. Gesundheitspfl. Dresden 1882, 33) boschreibt ein verbessertes Verfahren der Theobrominbestimmung in Cacao und Chocolade. 20—25 g Cacao oder 50 g Chocolade werden nach der vollständigen Entfettung mit 500 cbcm einer 4—5 procent. Schwefelsäure auf dem Wasserbade einige Stunden lang digerirt und das Theobromin aus der abfiltrirten sauren Lösung durch einen Ueberschuss von phosphorwolframsauren Natrium gefällt. Der Niederschlag, welcher noch Proteïnsubstanzen, Farbstoffe u. s. w. enthält, wird nach 24 Stunden filtrirt, mit einer 6—8 proc. Schwefelsäure gewaschen und dann in chlorfreier Natronlauge oder Sodalösung aufgelöst. Das Alkali der Lösung stumpft man so weit ab, dass die Reaction nur noch schwach alkalisch bleibt, dampft die Flüssigkeit mit Quarzsand ab und extrahirt den Rückstand, nach dem Trocknen bei 110° C., mit Amylalkohol bei 70—90° C. Der dazu zu verwendende Amylalkohol muss vorher mit Alkali behandelt rectificirt und von Wasser befreit sein. Das amylalkoholische Extract wird nach Abdestilliren des grössten Teiles des Amylalkohols in einer tarirten Platinschale vollkommen verdunstet, getrocknet und gewogen; darrauf ver-

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ascht man und zieht das Gewicht der Asche von der ersten Wägung ab; der Rest ist Theobramin. Die Asche besteht aus Kochsalz, herrührend von der Natronlauge. Statt Amylalkohol lässt sich auch Aethylalkohol anwenden, jedoch ist dann das Alkaloid nicht so rein und hinterlässt mehr Asche.

Nach Gebr. Stollwerk (D. P. 22555) wird zum Kühlen der Chocolade, um einen festen Bruch ohne braunweissliches Gefüge zu erzielen, ein durch einen Exhaustor hervorgebrachter Luftstrom von 10° R. angewendet. Die Abkühlung bewirkt man durch ein von Kühlwasser umgebenes System von Röhren. Die Chocolade passirt den Kühlraum auf Ketten oder Gurten ohne Ende, welche über Rollen laufen und gleichzeitig als Transporteure dienen.

XII. Gewürze.

Die Pharm. Centr.-H. **24**, 5 bringt eine Litteratur-Zusammenstellung über die bis jetzt veröffentlichten Methoden der Untersuchung der Gewürze mit Anführung der aufgestellten Grenzzahlen für die verschiedenen Bestandteile.

Saffran. Biel unterscheidet echten von gefälschtem Saffran mittelst Petroleumäther. Echte Saffrannarben nämlich lassen Petroleumäther ungefärbt. Eine Waare, welche Biel untersuchte, war mit Calendulae-Blüten gefälscht. Letztere waren mit Dinitrokresolnatrium gefärbt und mit Oel imprägnirt. (Pharm. Centr.-H. **23**, 619.) — Nach einer anderen Mitteilung (Ebenda **24**, 328) scheinen auch die wertlosen hellen gelben Fäden des naturellen Saffrans mit demselben Farbstoff gefärbt dem Saffran beigemischt zu werden. — Ueber die Prüfung des Saffransurrogates (Binitrokresolkalium bezw. Mono- und Trinitrokresolkalium, Pikrinsäure) liefert G. Heppe (Chem. Ztg. **6**, 1170) Mitteilungen. — R. Kayser (Repert. d. anal. Chem. **3**, 122 und **3**, 228) hat ein Saffranpulver mit einem Kunstproduct verfälscht gefunden, welch letzteres mit Hilfe eines Teerfarbstoffes und eines Zinnsalzes hergestellt war.

Pfeffer. Nach Niederstadt (Repert. d. anal. Chem. **3**, 68) lässt sich das procentische Verhältnis einer Verfälschung des Pfeffers mit Palmmehl durch die Bestimmung des Piperins nach der Methode von P. Cazeneuve und O. Caillol (Zeitschr. analyt. Chem. **17**, 379) berechnen. Ein vom Verfasser untersuchtes Pfefferpulver enthielt circa 80 Proc. Palmmehl. — Nach Ch. Girard (Monit. des prod. chim. **13**, 34) dienen als Verfälschung des Pfefferpulvers gepulverte Olivenkerne. Streut man den so verfälschten Pfeffer auf ein Gemisch von 1 Tl. Glycerin und 1 Tl. Alkohol, so sinken die Olivenkerne unter, Pfeffer bleibt an der Oberfläche. (Dupré.)

Ingwer. Tresh (Pharm. Journ. and Transact. **610**, 921) fand, dass das Aetherextract ausser dem flüchtigen Oele und dem wirksamer stechend schmeckenden Körper namentlich drei Harze und ein Terpen enthält. Das neutrale Harz hat die Formel $C^{16}H^{24}O^3$; die beiden anderen Harze sind sauer und durch neutr. und bas. Bleiacetat fällbar. (α-Harz $C^{46}H^{34}O^{10}$; β-Harz $C^{48}H^{60}O^8$).

Nelken. Nach Angaben des Quinologist **1**, 107 fanden sich in einem von Zanzibar bezogenen Posten Nelken in London einige Säcke künstlich

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nachgemachter Nelken vor, welche aus weichem Holze gearbeitet, dunkel gefärbt und mit Nelkenöl imprägnirt waren.

Senf. Eine Methode zur Analyse des Senfs teilen A. R. Leeds und E. Everhardt (Zeitschr. f. analyt. Chem. **21**, 389) mit. Feuchtigkeit und Asche werden wie gewöhnlich bestimmt. Das Oel wird zuerst mit Aether, dann das rhodanwasserstoffsaure Sinapin und das myronsaure Kalium mit Alkohol extrahirt, wobei das Myrosin mit der Cellulose ungelöst zurückbleibt.

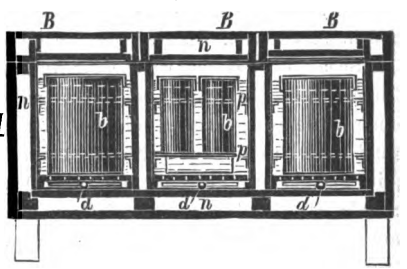
XIII. Essig.

W. Knop (Chem. Ztg. **7**, 696) fand in 100 cbcm eines Essigs 0·6699 g Zink (bestimmt als Schwefelzink). Diese schädliche Verunreinigung kann nur von einer misbräuchlichen Benutzung von Zinkgefässen herrühren. — Zum Nachweis freier Schwefelsäure in Essig (auch in Wein) taucht man nach Polacci ein mit Salzsäure gereinigtes Filtrirpapier in diesen ein, so dass das Papier über den Rand herausragt, lässt 24—36 Stunden stehen und trennt dann das herausragende Ende ab. Letzteres wird zerschnitten und mit Aether extrahirt, welcher die Schwefelsäure aufnimmt, die man als Bariumsulfat nachweisen kann. (Annali di Chim. applic. No. 6, Juni 1883.) — Der Lagmi-Essig wird nach Georges (L'Union pharm. d. Rundschau 1883, 480) in Algerien durch Gährung des Saftes einer Palmenart bereitet. Er besitzt einen schwach buttersäureähnlichen Geruch und angenehm sauren Geschmack, enthält 6·20 Proc. Essigsäure, 18·60 Proc. Glucose im Liter, eine bedeutende Menge Mannit oder eine in siedendem Alkohol unlösliche und Fehling'sche Lösung nicht reducirende Zuckerart.

XIV. Kochen und Conserviren.

Der Wasser- oder Dampfapparat zum Kochen der Speisen von Willy Becker (D. P. 21270) besteht aus einem doppelwandigen Holzkasten *A* mit Kammern, welche innen mit einem nicht oxydirbaren Metallblech verkleidet sind. Jede Kammer enthält einen dicht schliessbaren doppelwandigen Deckel *B*. In jede mündet in der Nähe des Bodens ein Dampfrohr *d* mit Verschlussventil. Die Dampfrohre *d* sind durch einen Siebboden überdeckt. Die Kammern werden mit Wasser gefüllt, in welches hinein die mit den zu kochenden Speisen gefüllten Töpfe *b b* gestellt werden. Diese kommen in Ausschnitte der Platten *p*. Die Deckel der Töpfe reichen mit ihren Kanten bis unter das Niveau des Wassers, so dass die in den Töpfen sich entwickelnden Dämpfe zwar austreten, die aus dem Wasserbade sich entwickelnden Dämpfe aber nicht in die Töpfe eintreten können. Man kann die Töpfe auch luftdicht verschliessen und anstatt

Fig. 280.



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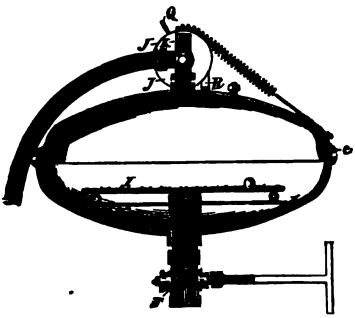
des Wasserbades nur Dampf zum Kochen benutzen. Letztere Methode wendet man namentlich für transportable Herde an. Die Zwischenräume *n* dienen zur Aufnahme von schlechten Wärmeleitern. Ueberlaufrohre verhindern ein zu hohes Steigen des Wassers in den einzelnen Kammern in Folge condensirten Wasserdampfes.

Sehr viele Truppenteile und einige Krankenhäuser benutzen das Becker'sche Verfahren bereits mit Vorteil.

Thomas Stead in London. Neuerungen an Apparaten zum Conserviren von Eiern. (D. P. 18776.) In einem zweiteiligen luftdichten Gefäss kann ein Vacuum erzeugt werden. Nach Entfernung des Oberteils *C* bringt man das Gestell *I* mit den zu conservirenden Eiern an seinen Platz und schliesst das Gefäss. Alsdann wird bei geschlossenem Hahn *F*, der mit dem Reservoir der Conservirungsflüssigkeit in Verbindung steht, der Zweiweghahn *J*, so gedreht, dass das Innere des Gefässes durch Rohr J^1 mit der Luftpumpe in Verbindung steht. Lässt man nach genügender Wirkung der Luftpumpe nun den Hebel *Q* auf dem Küken des Hahnes *J*, mittelst dessen der Hahn gedreht wurde, los, so schliesst sich dieser unter Einwirkung der Feder *N* wieder. Durch Oeffnen des Hahns *F* lässt man Conservirungsflüssigkeit in das Gefäss ein. Dieselbe ergiesst sich über die Eier. Durch Oeffnen des Hahnes *R* wird nun sofort das Vacuum aufgehoben, und die nicht gebrauchte Conservirungsflüssigkeit läuft in das Reservoir zurück.

Fig. 281.



A. Magaud in Vourles. Verfahren für dauernde Aufbewahrung von Früchten, Blumen, Blätter, Gemüse etc. (D. P. 21196 vom 31. Mai 1882.) Die Schale oder Hülle, welche zur Aufnahme und Aufbewahrung von Früchten, Blumen etc. bestimmt ist, wird aus Cement, Kalk, Thon, Lehm oder einer anderen genügend dichten Masse hergestellt. Um die Schale genügend hart und gegen Nässe unempfindlich zu machen, wird dieselbe mit geeigneten Flüssigkeiten wie Oel, Salzlösungen etc. bestrichen; die Schale wird im Innern mit Blättern von dem Baume der betreffenden Frucht ausgefüttert. — Ernst Glanz in Berlin. Verfahren zur Darstellung antiseptischer Flüssigkeiten, welche essigsaure oder ameisensaure Thonerde enthalten. (D. P. 20913 vom 22. April 1882.) Gegenstand des Patents ist die Verwendung einer Mischung von essigsaurer und ameisensaurer Thonerde, welche durch Wechselzersetzung zwischen essigsaurem und ameisensaurem Kalk, Strontian, Baryt oder Bleioxyd mit schwefelsaurer Thonerde oder durch Auflösen von Thonerdehydrat in einem Gemisch von Essigsäure und Ameisensäure erzeugt ist, zu Desinfectionszwecken.

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Ad. Mayer (Pharm. Centralh. 24, 23) untersuchte drei Conservirungsmittel: 1. Stuttgarter Conservirungssalz, dreifach und einfach concentrirtes, besteht aus Borsäure und Kochsalz und zwar das erstere aus 2 g Borsäure und 3 g Kochsalz, das zweite enthält weniger Borsäure, ferner Salpeter und Magnesiasalze. 2. Septon (Conservirungsmittel für Käse), besteht aus einer mit dem gleichen Volumen Wasser verdünnten Essigsäure. 3. Glacialin-Salzgemenge und Glacialin-Rosenextrat (für alle möglichen Nahrungsmittel) bestehen aus Borsäure und Borax. Diese als Geheimmittel verkaufte Conservirungspräparate werden alle viel teurer verkauft, als dem Wert ihrer Bestandteile entspricht.

Bei den Versuchen über die Anwendbarkeit der Borsäure zur Conservirung von Speisen, welche J. Forster (Ber. Chem. Ges. **16**, 1754) anstellte, ergab es sich, dass die Aufnahme von Borsäure mit den Speisen einerseits zu einer vermehrten Gallenabsonderung, andererseits aber zu einer vermehrten Entleerung von eiweissartigen Substanzen, die wohl zum grössten Teil von den aufgenommenen Speisen stammen, aus dem Darmcanal führt. Im Gegensatz hierzu kommt Ferd. Vigier in Gemeinschaft mit Laborde und Rondeau (Journ. Pharm. Chim. d. Pharm. Centralh. **24**, 198) zu dem Ergebnis, dass die Borsäure selbst in ziemlich hoher Dosis vollständig ungiftig ist, vorausgesetzt, dass sie rein und besonders frei von Thonerde, Bleisalzen und Soda ist, Verunreinigungen, die im Borax des Handels vorkommen.

B. Proskauer.

Statistik.

Im Deutschen Reich betrug in metr. Centnern ausgedrückt, die

Waarengattung	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an Kaffee, rohem	1 071 145	1 111 224	354	372
„ Cacao in Bohnen	25 569	27 396	5	7
„ Thee	14 842	15 721	212	184
„ Butter, auch künstlicher . .	46 641	45 100	116 584	127 335
an Hopfen	16 175	18 202	120 922	108 649
„ Bier aller Art, auch Meth .	127 608	132 792	1 285 475	1 281 130
an Arrak, Rum, Franzbranntwein	35 583	38 634	2 722	2 009
„ anderem Branntwein aller Art, mit Ausschluss des versetzten	5 627	4 912	909 632	608 439

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XXIX. Abfallstoffe, künstliche Dünger und Desinfection.

I. Guano, Superphosphat, Entphosphorungsschlacken.

Ein australischer Guano enthält nach Griffiths 46·7 Proc. stickstoffhaltige organische Stoffe (?) und Ammoniaksalze, 15 Proc. Phosphorsäure, (Centralbl. Apriculturchem. 1883 S. 427). Die landwirtschaftliche Versuchsstation in Bonn berichtet über verfälschten Guano, aus Phosphorit-Superphosphat, wenig schwefelsaurem Ammoniak und Fleischmehl bestehend.

Nach H. Albert hat die grössere Aufnahme der Ammoniak-Soda-Fabrikation in England eine grosse Menge Schwefelsäure disponibel gemacht, die nun mit gemahlenem Phosphat zu Superphosphat verarbeitet wurde. Dieses wird neuerdings zu einem die Productionskosten kaum deckenden Preise auf den deutschen Markt geworfen, wodurch die hiesige Industrie schwer bedroht erscheint. (Chem. Ind. 6, 149.)

Post (Chem. Ind. 5. S. 217) hat das Zurückgehen eines Superphosphates von H. & E. Albert untersucht. Die wässerigen Auszüge enthielten am 10. April, 17. Juni und 15. October freies P^2O^5: 6·18, 4·91, 3·62 Proc., — an Kalk gebundenes P^2O^5: 3·27, 4·23, 3·83 Proc., — an Eisen und Thonerde gebundenes P^2O^5: 0·67, 0·36 und 0·05 Proc. Die Citratauszüge bei 40° der drei Termine enthielten an Kalk gebundenes P^2O^5: 0·62, 1·62 und 1·30 Proc. und an Eisen und Thonerde gebundenes P^2O^5: 0·54, 1·07 und 1·80 Proc. Die dann mit Citrat bei 90° behandelte Masse ergab in den drei Terminen an Kalk gebundenes P^2O^5: 0; 0·69 und 0·65 Proc. Der Rückstand enthielt dann noch 3·8, 3·0 und 3·6 Proc. P^2O^5. Es hat also sowol das in Wasser, wie das in Citratlösung lösliche Calciumphosphat an Menge zugenommen, dann aber sich wieder etwas vermindert; das ursprünglich wasserlösliche Eisen-Aluminiumphosphat hat sich abgeschieden und ausserdem hat sich ein Teil freier Phosphorsäure mit sonst unlöslicher Thonerde oder Eisenoyd verbunden, beides unter Bildung von in Citrat löslichem Eisen-Aluminiumphosphat. Das nur in Salzsäure lösliche Phosphat hat sich zunächst vermindert, dann aber wieder zugenommen.

Zur Reinigung von Gas und Bereitung einer Art von Ammoniaksuperphosphat wird von J. Duke in Glastonbury, Engl. P. 2981 vom 23. Juni 1882, phosphorsaurer Kalk mit Salzsäure behandelt. Dann wird der Kalk durch Schwefelsäure gefällt. Das saure Calciumphosphat und der Gyps werden mit Torfkohle und einem anderen porösen Material gemischt, und die Mischung kommt in feuchtem Zustand in die Gasreiniger. Auch soll event. noch Kainit hinzugesetzt werden. *)

*) Techn.-chem. Jahrb. 1883, S. 122.

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Von H. Y. D. Scott in Sydenham, (Engl. P. 311 vom 21. Januar 1882), wird für Herstellung einer ähnlichen Masse gepulvertes Phosphat mit soviel Schwefelsäure behandelt, dass alle Phosphorsäure in Freiheit gesetzt wird. Ferner wird Magnesia, welche durch Auswaschen des Kalks aus gebranntem Dolomit erhalten werden kann, in Gaswasser verteilt und durch Einleiten von Kohlensäure in Carbonat umgewandelt, welches sich mit dem Ammoniumcarbonat des Gaswassers zu einem Doppelcarbonat verbindet. Dieses wird abgeschieden. Die von demselben abgezogene Flüssigkeit wird mit Magnesia und Phosphorsäure versetzt, um alles noch vorhandene Ammoniak als phosphorsaure Ammoniak-Magnesia zu fällen. Aus dem Doppelcarbonat wird durch die früher erhaltene Phosphorsäure die Kohlensäure für den oben angegebenen Zweck ausgetrieben, und das dabei resultirende Salz mit der phosphorsauren Ammoniak-Magnesia gemischt. Es kann aber auch die Phosphorsäurelösung direct mit Magnesia oder Kalk oder stickstoffhaltigen Abfallstoffen, welche Alkalien oder alkalische Erden enthalten, neutralisirt werden, besonders wenn das Rohproduct schon Stickstoff enthält.

Märcker (N. Z. Rübenz. Ind. 1881, 93) hält die bei der Entphosphorung nach Thomas abfallende phosphorsäurehaltige Schlacke für geeignet zur directen Anwendung als Düngemittel. Sie enthält ca. 18 Proc. Phosphorsäure. Nach Rocour (D. P. No. 21240) werden die phosphorhaltigen Metallschlacken in einem Schachtofen durch reducirendes Schmelzen in einen Lech umgewandelt. Dieser wird beim Abstechen granulirt und mit heisser Schwefelsäure oder Salzsäure behandelt. Die Zersetzung findet unter Entweichen von Wasserstoff und Phosphorwasserstoff statt. Diese Gase werden durch ein Rohr nach einer Anzahl Brenner geleitet, durch welche ein kleiner Flammofen erwärmt wird. Der beim Verbrennen erzeugte Wasserdampf und die Phosphorsäure werden nach einer besonderen Condensationscolonne geleitet. Die Phosphorsäure wird hierbei als wässrige Lösung gewonnen und ist Handelsartikel. Bei der Zersetzung des Lechs bildet sich eine Lösung von Eisen- und Manganchlorür oder Eisen- und Mangansulfat, die Phosphor als saures Phosphat enthält. Aus der salzsauren Lösung kann man Eisen und Mangen durch Kalk oder durch kohlensauren Kalk nach bekanntem Verfahren fällen. Statt des Kalkes kann man mit Vorteil auch zerkleinerte Schlacken des basischen Frischprocesses benutzen, die einen Ueberschuss an Kalk enthalten. In diesem Falle treten die Eisen- und Manganoxyde und die Phosphorsäure dieser Schlacken zu dem Oxyd- und phosphorsauren Eisen-Niederschlag hinzu und vermindern so die Kosten der Concentration eines entsprechenden Lechs. Die Phosphorsäure schlägt sich als basisch-phosphorsaures Eisen neben Eisenoxyd nieder. Um beide Producte zu trennen und die Phosphorsäure in für die Phosphatfabrikanten brauchbarer Form zu erhalten, mischt man den phosphorsauren Eisenniederschlag mit schwefelsaurem Kali und calcinirt das Gemenge im Flammofen. Die Masse wird dann mit Wasser ausgelaugt und das gelöste phosphorsaure Kali zur Krystallisation gebracht.

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Winkelhofer in Neutitschein, Mähren (D. P. 23397) will Phosphorite und basische Entphosphorungsschlacken vom überschüssigen Kalk befreien, indem er diesen, falls er als Kalk vorhanden ist, direct und, falls er als kohlensaurer Kalk vorhanden, nach dem Glühen mit Zuckerlösung behandelt. Aus der entstandenen Zuckerkalklösung wird der Kalk durch Kohlensäure entfernt, worauf sie von neuem benutzt wird.

Einen grossen Fortschritt in der Verarbeitung der basischen Entphospherungsschlacken hat C. Scheibler gemacht. Zur Ausbeutung seines neuen Verfahrens hat er sich mit den Hoerder-Werken verbunden. Das Verfahren ist unter No. 24130 vom 30. November 1882, Pieper in Berlin, patentirt. Es beruht darauf, dass die Schlacken nach passender Zerkleinerung in oxydirender Flamme geröstet werden. Es gehen hierbei Eisenoxydul und Manganoxydul in schwer lösliche Oxyde bezw. Oxyduloxyde über. Sie werden dann mit verdünnter Säure behandelt, wobei die freien und die an Kieselsäure bezw. Phosphorsäure gebundenen Erdbasen, sowie die Phosphorsäure und Kieselsäure in Lösung gehen. Aus dieser Lösung werden durch Kalk, Magnesia oder Dolomit je nach deren Menge mehr oder weniger kieselsäurehaltige Phosphate gefällt, die direct als Dünger Verwendung finden. Der von der Säure nicht gelöste Teil der gerösteten Schlacke bildet ein manganreiches Erz, wie solches jetzt sehr gesucht ist.

Nach einem Oesterr. Pat. vom 22. Dec. 1881, Liedermann, sollen gewisse Trachyte so reich an schwefelsaurem Kali sein, dass sie, durch Glühen aufgeschlossen, einen brauchbaren Dünger geben. (Chem. Ind. 5, S. 236.)

II. Dünger aus tierischen Abfällen.

A. Stutzer (Journ. f. Landwirtsch. 1882 S. 363) nimmt an, dass das Löslichwerden des Stickstoffs der Düngemittel in ähnlicher Weise durch Fermente vor sich gehe, wie bei der Verdauung. Zur Bestimmung des löslichen Stickstoffs behandelt er die Dünger daher mit Pepsin und findet, dass von dem gesamten Stickstoff in Lösung gehen, z. B. bei Blutmehl 90 Proc., Ledermehl 39 Proc., rohen Hornspänen 23 Proc., Liernur-Poudrette 80 Proc., rohem Knochenmehl 95 bis 98 Proc., gedämpftem Knochenmehl 88 bis 93 Proc., rohem Peruguano 95 Proc.

Nach Dietzel (Ber. chem. Ges. 1882 S. 551) geht bei der Fäulnis organischer stickstoffhaltiger Düngemittel Stickstoff als solcher verloren; man soll dies vermeiden durch Zugabe von Kalk in den Ansammlungsgruben.

Blutdünger will Marguerite-Delacharlonny durch Gerinnenlassen von Blut mit wenig saurem Ferrisulfat, $Fe^2O^3 \cdot 4SO^3$, und Abpressen herstellen. (Compt. rend. 95 S. 841.)

Nach Th. Richters in Breslau (D. P. 18647) werden stickstoffhaltige Abfälle, wie Horn, Leder, Wolle, Haare etc., mit verdünnter Schwefelsäure getränkt, gelinde erwärmt und darauf unter Luftzutritt zuerst bis 100° erhitzt, um die Schwefelsäure in der Substanz zu concentriren. Hierauf findet

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eine weitere Erhitzung bis 250° und völlige Trocknung statt, wobei die Structur der Abfallstoffe zerstört wird, ohne dass jedoch eine Verbrennung eintreten kann; die Masse wird nach dem Erkalten gemahlen.

Von J. N. B. Bond jun. in New-York (D. P. 21290) werden zur Herstellung von Stickstoffdünger Fleischabfälle, Excremente, Oele, Fette und andere ähnliche Substanzen in fein zerteiltem Zustande und in einer verdünnten Atmosphäre verkohlt.

Nach A. Petermann (Ann. agronomiques 1882 S. 77, Centr.-Bl. Agriculturchem. 1882 S. 454) liefert die Bearbeitung der rohen Wolle in den industriereichen Gegenden Belgiens Abfälle, die jetzt in Schwefelsäure oder durch Behandlung mit gespannten Wasserdämpfen gelöst werden; die Lösung wird zur Trockne verdampft und der Rückstand gepulvert. Die so hergestellte gelöste Wolle ist fast vollständig in Wasser löslich; sie enthält 9—12 Proc. Stickstoff, davon circa 2·4 Proc. als Ammoniak, während die rohen Wollabfälle circa 4 Proc. Stickstoff enthalten.

III. Städtische und gewerbliche Abfallstoffe.

Nach der Société anonyme des produits chimiques du Sud-Ouest in Paris (D. P. 19776 vom 30. November 1881) sollen die Abfuhrstoffe der Städte in folgender Weise behandelt werden, um einerseits die darin enthaltenen festen Stoffe zu Poudrette zu verarbeiten, die flüssigen Stoffe aber geruchlos zu machen und aus ihnen schwefelsaures Ammoniak zu erhalten. Die Massen werden zunächst entschwefelt, indem man soviel Zinnvitriollösung von 18° B. hinzufügt, dass dadurch zwar das Ammoniumsulfhydrat, nicht aber das Ammoniumcarbonat zersetzt wird. Man kann hierbei etwas Kalk, Alaun oder Kohlenstaub etc. hinzusetzen. Der Niederschlag setzt sich ab; die Flüssigkeit kann grösstenteils als klare Flüssigkeit abgezogen werden. Der Rückstand wird nochmals mit Zinkvitriollösung behandelt. Nachdem er sich abgesetzt hat und die darüber stehende Flüssigkeit abgezogen ist, wird er in Filterpressen abgepresst. Die verschiedenen Flüssigkeiten werden auf schwefelsaures Ammoniak verarbeitet.

Aehnliche Verfahren scheinen auch in Deutschland Eingang gefunden zu haben, denn eine Freiburger Poudrette enthielt 3·5 Proc. Schwefelzink, welches nach Nessler und König (Wochenbl. d. Bad. landw. Vereins 1882 S. 97, Chem. Ztg. 1882 S. 1375) für die Vegetation schädlich ist.

Gefaulter Urin, Gaswasser etc. wird nach Mc. Dougall in Penrith (Engl. P. 202 vom 14. Januar 1882) mit Sägemehl, gebrauchter Gerberlohe, Torf und ausserdem mit den Sulfaten oder Chloriden von Calcium oder Magnesium behandelt. Es bilden sich Ammoniumsulfat bezw. Chlorid und unlösliche Carbonate von Calcium oder Magnesium.

De Soulages in Paris (D. P. 22114) will Latrinenstoffe in Dünger verwandeln, indem er sie, nach Hinzugabe pulverförmiger organischer Stoffe, bei Luftabschluss glüht und das condensirte Destillat mit der in den Retorten bleibenden Kohle mischt.

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Zur Darstellung von Dünger (Rossguano) aus dem mit Urin und Excrementen von Pferden durchtränkten Stroh der Pferdeställe wird dieses nach Th. H. Cobley in Dunstable (D. P. 20590.) mit Wasser und einer geeigneten Menge Säure, die bei der Behandlung von Knochen mit Salzsäure erhalten wird, also phosphorsauren Kalk enthält, systematisch ausgelaugt. Dieser Flüssigkeit wird ein Gemisch verschiedener Chloride, Eisenchlorid, Chloraluminium, Chlorcalcium und Chlormagnesium, oder Sulfate, schwefelsaure Thonerde, schwefelsaures Eisenoxydul, schwefelsaure Magnesia, schwefelsaures Kali, schwefelsaures Natron zugesetzt. Dann wird abgedampft. Endlich formt man die eingedickte Flüssigkeit unter Zusatz der kohlehaltigen Masse, die man bei der Fabrikation von gelbem Blutlaugensalz, nachdem die Ferrocyanide ausgewaschen sind, als Abfall erhält (die s. g. Schwärze), in Filterpressen zu Kuchen oder mengt dieselbe mit Torfasche, Torfpulver, gebranntem Schiefer, gebranntem oder ungebranntem Kainit u. dgl.*)

Zur Reinigung von Canalisationsabwässern will H. Petri in Berlin (D. P. 19098 vom 10. November 1881), bei offenen Filtern mit seitlichem Eintritt des Wassers die eigentliche Filtrirschicht mit einer Deckschicht überlegen, welche aus mit Carbolwasser getränkten Torfstücken und einer Lage von Kaliumbisulfat oder Superphosphat besteht. Letztere Lage wird mit Luft durchlassenden Stoffen gemischt. Es soll durch die Bedeckung ein Anfaulen der Filtermassen durch Uebersättigung mit Auswurfstoffen unter Einfluss der Luft vermieden werden.

Bowen in London (Engl. P. 2086 vom 3. Mai 1882) will ein Material zum Filtriren und Geruchlosmachen der Abflusswässer durch Vercokung von mit Thon gemischter Cannelkohle gewinnen.

A. Petermann (Ann. agronomiques 1882, S. 135; Centrbl. Agriculturchem. 1882, S. 462) macht Mitteilungen über die Zusammensetzung verschiedener zur Compostbereitung geeigneter Materialien, so von Schlamm und von einer Anzahl gewerblicher Abfälle.

Fleischer, (Centrbl. Agriculturchem. 1883, S. 368) weist nach, dass sich wie der Moostorf der norddeutschen Hochmoore auch Fasertorfarten (aus Württemberg und Schlesien) zum Einstreuen und zum Düngen eignen.

Abwässer von Papierfabriken s. Drewsen Hann. land- und forstw. Ztg. 1881, S. 465 und Meissner, Papierztg. 1882, S. 625 und 1040.

F. Fischer hat die Canalgase in Schwemmcanälen untersucht und tritt der Behauptung entgegen, dass durch sie epidemische Krankheiten besonders verbreitet werden. Dingl. polyt. Journ. 248, 501.

Nach dem System von Ch. T. Liernur in Haarlem wird diese Stadt in Bezirke von 4 bis 10 Hektaren Fläche eingetheilt. In jedem Bezirk wird ein luftdichtes Reservoir unter dem Pflaster angelegt, das durch Bezirks-Rohre mit den Syphons der Abortsrohre der Häuser in Verbindung

*) Techn.-chem. Jahrb. 1882, S. 316.

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steht. Die Bezirksrohre sind durch Hähne von dem Reservoir abschliessbar. Soll die Entleerung der verschiedenen Abortssyphon stattfinden, so stellt man erst eine Luft-Verdünnung in dem Reservoir her und öffnet dann die Hähne der Bezirksrohre. Alle Reservoire sind durch Rauptrohre mit Pumpen verbunden, die zur Herstellung des Vacuums in den Reservoiren und zur Entleerung derselben arbeiten. Es sind die Hauptrohre teils Luftverdünnungsrohre, teils Transportrohre für die Excremente. Beide Arten von Rohren sind mit Hähnen versehen. Beim Betrieb müssen zunächst die Hähne der Luftrohre offen gestellt werden, um in den Reservoiren eine Luftverdünnung zu erzeugen, nach Schluss dieser Hähne sind die Bezirksrohre zu öffnen und zu schliessen, schliesslich sind die Transportrohre zu öffnen und zu schliessen. Diese Manipulationen wurden bisher durch Arbeiter vorgenommen, die in zu den Reservoiren gehörige Schächte einzusteigen hatten, welche die Hähne enthielten; die Arbeit dauerte jedesmal $^1/_2$ bis 1 Stunde. Diesen Uebelstand sucht nun der Erfinder nach D. P. 17374 vom 9. August 1881 dadurch abzustellen, dass er die betreffenden Hähne automatisch öffnet und schliesst. Es steht demnach mit dem Schlüssel jedes Hahnes der Kolben eines Cylinders in Verbindung. Dieser Kolben wird gehoben, sobald in dem Cylinder ein Vacuum hergestellt wird; er sinkt durch eigene Schwere, sobald man in den Cylinder Luft einlässt. Es sind alle Cylinder mit dem Haupt-Luftverdünnungsrohr verbunden. Ein Ventil stellt bei Oeffnung diese Verbindung her, ein zweites Ventil lässt Luft in den Cylinder. Beide Ventile werden durch eine Stift-Walze geöffnet und geschlossen (ähnlich wie bei einem Musikwerke). Der Antrieb dieser Walze erfolgt durch ein Uhrwerk, das seinerseits an das Luftverdünnungsrohr angeschlossen ist und durch den Ueberdruck der Atmosphäre in ständiger Bewegung gehalten wird.

Ueber den Düngewert von Absätzen aus städtischen Schmutzwassercanälen mit besonderer Rücksicht auf Bremer Verhältnisse s. Fleischer, Centralbl. Agriculturchem. 1883, S. 426.

Roeckner in Newcastle, Apparat zum Klären von Schmutzwassern, D. P. 20882.

IV. Analytische Verfahren.

Gewichtsanalytische Bestimmung der Phosphorsäure von Mayer und v. Schmid durch Fällen mit Magnesiamischung in stark ammoniakalischer Lösung bei Gegenwart von citronensaurem Ammoniak. (Journ. f. Landwirthsch. 1882, S. 181, Centralbl. Agriculturchem. 1882, S. 784.)

C. Mohr hat die Joulie'sche Methode der titrimetrischen Bestimmung der phosphorsauren Ammoniakmagnesia mittelst Uranlösung geprüft (Zeitschr. analyt. Chem., 21, 216) und schlägt für dieselbe eine Abänderung vor. Ebenso hat er das von ihm selbst (Ber. d. d. chem. Ges. 13, 1036) angegebene Verfahren zur Bestimmung von Phosphorsäure bei Gegenwart von Eisen mittelst Uranlösung etwas modificirt.

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Stünkel, Wetzke und P. Wagner geben Vorschriften für die zweckmässige Ausführung der Bestimmung der Phosphorsäure mittelst Molybdänlösung. (Zeitschr. analyt. Chem. 21, 353.)

v. d. Pfordten (Ber. chem. Ges. 15, 1925.) löst den Niederschlag von phosphormolybdänsaurem Ammoniak in Ammoniak, reducirt mit Salzsäure und Zink bis zur Bildung des Molybdänsuboxydes und führt dieses durch Titriren mit Chamaeleon in Sesquioxyd über (vgl. a. König, Centralbl. Agriculturchem. 1883, S. 283).

Pemperton versetzt zur Phosphorsäurebestimmung die freie Säure mit Ueberschuss von Ammoniumnitrat und dann mit Ammoniummolybdänat. (Chem. News 46, 4.)

Kratschmer & Sztankovantzky fügen zu dem phosphorsauren Salz Silbernitrat, erhitzen und filtriren. Im Filtrat wird überschüssiges Silber nach Volhard oder Mohr bestimmt. (Zeitschr. analyt. Chem. 21, 523.)

Mollenda (Zeitschr. analyt. Chem. 22, 155) bestimmt den sauren phosphorsauren Kalk in solchen Superphosphaten, welche keine freie Säure enthalten, indem er aus der Lösung den Kalk durch oxalsaures Natron ausfällt und das Filtrat mit kohlensaurem Natron oder halb normaler Aetznatronlauge titrirt; es bildet sich das gewöhnliche phosphorsaure Natron, Na^2HPO^4. Bei Anwendung von Natronlauge kann die Titration in der Kälte ausgeführt und darum auch auf Ammoniaksuperphosphate angewendet werden.

Eine Zusammenstellung der Resultate verschiedener Forscher über die analytische Bestimmung der zurückgegangenen (citratlöslichen) Phosphorsäure giebt König im Centralbl. Agriculturchem. 1882, S. 525.

Zur Bestimmung der zurückgegangenen Phosphorsäure haben einige Fabrikanten oxalsaures Ammoniak verwendet. Nach Richardson (Chem. Ind. 6, 16 nach Amer. chem. Journ.) wirkt dasselbe allerdings schneller als das citronensaure Ammoniak; ist jedoch nicht vorzuziehen.

Gladding hat die Fresenius'sche Methode zur Bestimmung der zurückgegangenen Phosphorsäure noch näher geprüft, er ändert sie dahin ab, dass er $^1/_2$ Stunde bei 65° mit leicht ammoniakalischer Citratlösung in geschlossenen Gefässen digerirt. (Chem. Ind. 5, 383 nach Mon. scient.)

v. Ollech, Bestimmung der „halblöslichen" Phosphorsäure mittelst Citronensäure. (Centralbl. Agriculturchem. 1882, S. 853 und 1883 S. 138, Journ. für Landwirtsch. 1882, S. 519.)

H. Tamm (Chem. News 45, 225) findet, dass bei Gegenwart von Natronkalk und Grubengas in der Rotglühhitze alle Oxyde des Stickstoffs zu Ammoniak reducirt werden. Er bestimmt daher den Gesamtstickstoff in Salpeter, Dünger etc., indem er die Substanz mit Natronkalk und Natriumacetat mischt und bei vorgelegtem Natronkalk nach der Will & Varrentrapp'schen Methode verbrennt. Den ammoniakalischen Stickstoff kann man in einer zweiten Probe bestimmen, indem man die Substanz mit Natronkalk und oxalsauren Kalk verbrennt. Den in Form von salpetriger Säure vorhandenen Stickstoff findet er durch Kochen der Substanz mit

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überschüssiger Essigsäure, Eintrocknen und Bestimmung des zurückbleibenden Stickstoffs mit Natronkalk und Natriumacetat.

Zur Bestimmung des Stickstoffs bei Gegenwart von Nitraten verwirft Ruffle das Verfahren von König & Goldberg (Verbrennen mit einer Mischung von Natronkalk, Weinsäure und xanthogensaurem Kali) und empfiehlt Verbrennen mit Gemisch aus Natronkalk, Natriumhyposulfit und Holzkohle. (Journ. soc. chem. ind. 1883, S. 21.)

Ueber die Methode der Bestimmung des Stickstoffs von Nitraten und Nitriten durch Reduction mit Zink und verdünnter Säure, s. Kinnear, Chem. News 46, 33.

Davy empfiehlt, Chem. News 46, 2, Nitrite durch die Braunfärbung mit Gallussäure nach Art der Nessler'schen Ammoniakprobe zu bestimmen.

Apparat zur Stickstoffbestimmung von Gladding, Chem. News 46, 39.

Zur Bestimmung des Kalis in Düngemitteln giebt Dreyfus (Chem. Centralbl. 1882, S. 825) an, die Substanz mit Schwefelsäure von 66° B. zu behandeln, dann zu glühen, auszulaugen, die Schwefelsäure durch Barytwasser und den überschüssigen Baryt durch Ammoniumcarbonat zu fällen. In Lösung befindliche Spuren von Kalk werden durch wenig oxalsaures Ammon beseitigt, das Filtrat wird eingedampft und nach dem Verjagen der Ammoniaksalze das Kalium durch Platinchlorid gefällt.

V. Antiseptica, Desinfection.

Nach Paul Bert & P. Regnard (Compt. rend. Bd. 94, S. 1383) hemmt Wasserstoffsuperoxyd sofort jede durch organisirte Fermente veranlasste Gährung, indem das Ferment getödtet wird, ist aber ohne Wirkung auf lösliche Fermente (Speichel, Diastase, Magen- und Pankreassaft).

Le Bon empfiehlt als Antiseptica Calcium- und Natriumglyceroborat, die er durch Erhitzen der wasserfreien Borate mit Glycerin auf 160° darstellt. (Compt. rend. 1882, S. 145.)

Ueber Darstellung des als Antisepticum so viel verwendeten Jodoforms giebt Rother neue Vorschriften (Journ. soc. chem. ind. 1882 S. 199).

Adolf Frank (D. P. 21074, 23350 und 21644 benutzt die nach eigentümlichem Verfahren aus Kieselguhr hergestellten porösen Massen nach Tränkung mit Brom als Desinfectionsmittel (vgl. S. 164). Sie werden hierbei entweder zur Lösung des Broms mit Wasser geschüttelt, oder in Gefässe gelegt, die durch einen Wasserverschluss abgeschlossen sind. Das Wasser in diesem nimmt das Brom auf und giebt es langsam ab. Zur Beseitigung des Bromgeruchs oder zur Verhinderung einer zu starken Einwirkung des Broms wird Petroleum oder Ligroin verwendet. — Ueber die desinficirende Wirkung des Bromdampfes s. a. Wernich, Centralbl. med. Wiss. 1882, S. 180.

Nach D. P. 18486 vom 26. August 1881 wenden Ch. Girard und J. A. Pabst in Paris eine Lösung von Bleikammerkrystallen in concentrirter Schwefelsäure an, um schädliche Gase zu zerstören. Die Wirkung soll darauf beruhen, dass die Schwefelsäure Wasser und organische

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Stoffe aufnimmt und die durch das Wasser aus den Bleikammerkrystallen entwickelte salpetrige Säure die Gase oxydirt. Eine Abortgrube wird z. B. in der Weise desinficirt, dass die darin befindlichen Gase in einen Coksturm geleitetet werden, dessen Inhalt mit einer Lösung von 5 Tln. Bleikammerkrystallen in 100 Tln. Schwefelsäure von 60° B. getränkt ist. Von dem Coksbehälter geht ein Ventilationsrohr ab, durch welches nur unschädliche Gase in die Luft entweichen.*)

Ueber Gewinnung von rohem Chloraluminium aus Lava und Salzsäure zur Desinfection, Huet, Journ. de Pharm. et de Chim. 5, S. 52.

Ein Desinfectionsmittel und Antisepticum erhält Th. Fr. Scott in London (Engl. P. 2361 vom 30. Mai 1881) durch Schmelzen von Braunstein mit Kali- oder Natronalaun.

Als desinficirende Flüssigkeit wird von Glanz in Berlin (D. P. 20913 vom 22. April 1882) ein Gemisch von essigsaurer und ameisensaurer Thonerde benutzt, das entweder durch Umsetzen von Alaun mit den entsprechenden Salzen des Strontiums oder durch Auflösen von colloidaler Thonerde in den freien Säuren erhalten wird.

Da sich die Wirkung von Chlor und schwefliger Säure auf die mikroskopischen Organismen als durchaus unzulänglich erwiesen hat, so lässt jetzt der Verwaltungsdirector Merke des Berliner Barackenlazareths heisse Wasserdämpfe direct auf die Stoffe etc. einwirken. Der verwendete Apparat wird von Schimmel in Chemnitz gebaut und ist für denselben unter D. P. 18713 vom 24. Novbr. 1881 patentirt.

Statistik.

Im Deutschen Reich betrug, in metrischen Centnern ausgedrückt, die

Waarengattung	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an Guano, natürlichem	1 063 160	921 686	16 298	18 261
„ Superphosphaten	248 787	304 319	66 852	68 156

Arthur Lehmann.

XXX. Gerberei.

Gerbstoffe. Gerbstoffextract aus einem Farnkraut *„sweet fern“* soll jetzt in East Machias, Maine, V. St. N.-A. hergestellt werden. (Gerber 9, 114.)

Müntz und Schön (Journ. de Pharm. et de Chim. 4, 583) haben gefunden, dass die Gerberinden beim Aufbewahren und besonders in Feuchtigkeit an Gerbstoff verlieren, nach $1^1/_2$ Jahren bis zur Hälfte desselben.

*) Techn.-chem. Jahrb. 1883, S. 318.

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Gerbstoffextraction. Ueber Brühenmesser, über die Extraction zweier Spiegelrinden und über den Gerbstoffgehalt der Eichenrinde s. Ebertz, Gerberzeitung 1882, 41, 290, 120 ff.

Der Extractions-Apparat von Gläser liefert nach Eitner $1\frac{1}{2}$ mal so starke Brühen als der Kohlrausch'sche, laugt das Material vollständiger aus, lässt keine heissen Brühen abfliessen, liefert mehr Brühen und kostet weniger als den vierten Teil des Kohlrausch'schen Apparates, (Gerber 8, S. 197, 243, 282). Das auszulaugende Material ist vollständig zu vermahlen, es wird beim Auslaugen bewegt und in den ersten Stadien der Auslaugung heiss ausgelaugt.

Pfeiffer's Extractionsapparat ist nach Simand (Gerber 9, 89) ein Geschirr mit doppeltem Boden, wobei von dem oberen Boden ein Rohr ausgeht, das oben mit einem Körting'schen Injector verbunden ist. Dieser pumpt die Brühe vom Boden des Gefässes aus und lässt sie oben wieder auf die Lohe ausfliessen. Die Extraction wird nicht für rationell erklärt, da ein und dieselbe Brühe 3 Stunden lang mit Dampfbegleitung um die Lohe herumgeführt wird.

Ein ähnlicher Apparat ohne Injector, bei dem zwischen den Doppelböden eine Dampfleitung liegt und die Circulation von selbst erfolgt s. das. 41.

Pavesi empfiehlt zur Beschleunigung der Gerbung, das zur Extraction der Rinden verwendete Wasser mit Holzessig anzusäuern. Derselbe will auch essigsaures Eisenoxyd als Gerbmittel anwenden. (Giorn. Farm. Chim. 31, 49).

Gerbstoffbestimmung. Simand findet (Dingl. pol. Journ. 244, 391), dass, wenn man nach Löwenthal erst die Gerbstoffabkochung mit Chamaeleon oxydirt, dann in einer zweiten Probe nach Ausfällung der Gerbsäure durch mit Salz und etwas Schwefelsäure versetzte Leimlösung die „Nichtgerbsäure" ebenfalls mit Chamaeleon oxydirt und die Gerbsäure durch die Differenz bestimmt, der Gerbstoffgehalt zu niedrig ausfällt, weil der gerbsaure Leim etwas in verdünnter Schwefelsäure löslich ist und somit bei der zweiten Titrirung ein etwas zu hohes Resultat ergiebt. — Er wendet daher statt der Leimlösung Hautblösse an und giebt Vorschriften zur Herstellung derselben (das. 246, 41). Noch bequemer sind für gleichen Zweck mit Salzsäure extrahirte Knochen oder Hornschläuche. (Dingl. pol. Journ. 246, 133; Gerber 9, 18.) Simand wendet auch eine indirecte gewichtsanalytische Bestimmung an, indem er eine Probe des Auszugs eindampft und eine zweite Probe nach Ausfällen des Gerbstoffs durch Hornschläuche ebenfalls eindampft; die Differenz giebt den Gerbstoff.

Nach Gerber 9, 63 werden die Hornschläuche passend so vorbereitet, dass man sie nach dem Extrahiren und Auswaschen zur Ausziehung des Wassers mehrere Male mit Alkohol und zuletzt mit Aether übergiesst. S. a. das. 4, 18.

Das für das Titriren mit Chamaeleon von Neubauer angegebene Aequivalent (63 g Oxalsäure = 41·57 g Tannin) ist nach Councler und Schröder

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(Ber. d. chem. Ges. 15, 1374) nicht richtig; dieselben finden 63 g Oxalsäure = 34·2 Tannin.

Vorbereitung. Nach der Halle aux Cuirs durch Gerber 8, 208 werden die Vergiftungen der Gerber durch Arsenikkipse nicht durch Arsenik, sondern durch Blattern hervorgebracht, die sich häufig in getrockneten Häuten finden und einen tödtlichen Stoff enthalten.

Rotgerberei. Eitner bespricht im „Gerber" 8, S. 111 f. die Extractgerberei, zunächst die ausländischen Methoden und unterscheidet hier drei Haupttypen, nämlich 1. das englische, 2. das amerikanische und 3. das amerikanisch-deutsche System.

Beim englischen System werden die Häute in drei Serien, jede zu acht Farben, in süssen, anfänglich schwachen, jedoch nach und nach stärker werdenden Brühen angegerbt, dann in zwei Serien, jede zu sechs Farben, in starken süssen Brühen weiter gegerbt und schliesslich in zwei bis drei Versteckfarben, welche mit sehr starker Brühe angestellt sind, fertig gegerbt. Eine Schwellung durch Sauerbrühe findet hier gar nicht statt, da bei dieser Art Gerbung keine eigentlichen Sauerbrühen erhalten werden; die Hebung des Leders wird lediglich mit Gerbstoff bewerkstelligt. Für die Angerbung werden schwächere Extracte, zumeist Rindenextracte, angewendet. Die weitere Gerbung erfolgt mit Brühen aus sehr gerbstoffreichen Materialien, wie Valonea, Myrobalanen, Divi, Catechu; diese Materialien liefern im Laufe der Gerbung sehr wenig oder gar keine Säure. Die nun ganz durchgegerbten Häute erhalten zum Schluss in den Versteckfarben Festigkeit, Fülle und Gewicht. Die Gruben sind zum Teil mit starker Brühe gefüllt; die Häute werden der Fläche nach eingeworfen und je mit wenig Gerbematerial, dem Mehl der genannten Substanzen, bestreut. Die Häute schwimmen in der Grube. Die Dauer der Gerbung beträgt drei bis vier Monate. Das Leder ist gewichtig und voll, aber nicht fest genug; hier muss eine intensive Appretur helfen.

Beim amerikanischen System der Hemlockgerberei erfolgt zunächst ein schnelles Anfärben in starker süsser Brühe. Dann werden die Häute geschwellt und zwar entweder vor der Angerbung mittelst Schwefelsäure oder gleichzeitig mit der Angerbung mit Sauerbrühe. Die schnelle Angerbung erfolgt in nach Bedürfnis sauren Brühen; die Brühen werden durch kalte Extraction von Versetzlohe gewonnen. Die eigentliche Gerbung erfolgt in einer Reihe von Versteckfarben (Versenkfarben), deren unterste mit schwächerer Brühe angesetzt werden als die oberen und die entsprechend der stärkeren zur Verwendung gebrachten Brühe immer länger stehen. Die ersten Gruben werden mit saurer Brühe, die anderen mit süsser Brühe teilweise gefüllt, ausserdem werden die Häute mit Lohe bestreut. Von der dritten Grube an werden die Brühen erwärmt und zwar bis zur sechsten von 25 bis 40° C. steigend. In diesem letzten Stadium nimmt die Haut viel Farbstoff auf. Die Hemlockrinde ist verhältnismässig

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nicht reich an Gerbstoff, dagegen säuert sie ausserordentlich schnell, sodass die Gerbung damit durchweg als eine sauere bezeichnet werden kann.

Bei der Verwendung von Kastanien-Eichenrinde zur Herstellung des Eichensohlleders ist die Gerbung in den Versteckfarben eine mehr süsse, da die Kastanien-Eichenrinde nicht so stark säuert; die Sätze werden schwimmend gegeben. In jenen Fabriken, welche die spanische Eiche verwenden, die leichter sauer wird, ist die Gerbung eine sauerere und das erzeugte Leder ein besseres. Durch Gerbung mit einem Gemisch von Hemlock- und Eichenrinde wird das hell und angenehm gefärbte Unionleder hergestellt. Die Gerbung dauert vier bis fünf Monate; das Product ist in besserer Marke von guter Qualität, guter Stellung und lohnendem Gewicht.

Bei dem amerikanisch-deutschen System werden die Häute mit Sauerbrühe gradatim in den Farben geschwellt. Die Sauerbrühe wird aus Versetzlohe erhalten; sie enthält viel Gerbstoff, so dass neben der Schwellung eine intensivere Angerbung erreicht wird. Für eine gleichzeitige Einwirkung von Säure und grösseren Gerbstoffmengen wird auch dadurch gesorgt, dass man teils in den oft folgenden Versetzfarben, teils in den ersten Sätzen Sauerbrühe, welche auf warmem Wege erzeugt wird, hinzugiebt. Für den Satz wird mehr Streumaterial als bei den früheren Gerbsystemen verwendet; die letzten Sätze werden mit starken süssen Extracten abgetränkt. Da die letzten Sätze längere Zeit stehen, so tritt gleichfalls Säuerung ein, so dass die Gerbung durchweg sauer geführt wird. Es wird Kastanien-Eichenrinde verwendet. Die Gerbung dauert 6—10 Monate und liefert Leder vorzüglicher Qualität, jedoch mit grosser Gerbstoffverschwendung.

Uebergehend auf österreichische Verhältnisse bespricht Ettner zunächst die Herstellung der Terzen. Gerber 8, S. 267, 279; 9, S. 1, 27, 39, 51, 75, 87. Diese Ledersorte entspricht dem, was in Deutschland Halbsohlleder oder Brandsohlleder genannt wird. (Es sind dies die durch Aeschern enthaarten Leder, während die durch Schwitzen enthaarten Leder das eigentliche Sohlleder geben.) Man unterscheidet Knoppern-Valonea-Terzen, Lohterzen der Alpenländer und Lohterzen Böhmens (Deutschleder), denen sich die Vacheleder, die eine besondere Appretur erhalten, anreihen. Die Knoppernterzen-Herstellung nach neuer Methode gewährt weniger eine Zeitersparnis, als eine Ersparnis an Gerbmaterial; bei der alten Methode geht nahezu die Hälfte des Gerbstoffs verloren. Nach früherer Methode erhält man ein Product, das durch Trocknen bei gewöhnlicher Temperatur zu wenig fest ist; man muss es bei höherer Temperatur trocknen, wodurch es aber eine gute Appretur nicht mehr zulässt; dieser Uebelstand fällt hier fort. Die Häute müssen zunächst richtig ausgewässert werden. Frische Häute kommen partienweise im Sommer 6 Stunden, im Winter 12 Stunden in frisches Wasser. Man schlägt sie auf, mistet ab, bearbeitet die Fleischseite und legt sie dann 24 Stunden in frisches Wasser. Gesalzene Häute werden eventuell nach Abkehren des Salzes 2 bis 3 Stunden eingeweicht, damit das Salz auszieht; man bringt sie dann in das zweite

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Weichwasser. Hierauf lässt man die Häute 3 Tage äschern. Die Häute sollen nicht prall aufgetrieben in den Aescher kommen, möglichst aufgehängt werden und bei Temperatur von 16 bis 20° äschern. Man benutzt zwei Aescher, einen frischen und einen bereits einmal benutzten. Durch Dampf oder durch Eintauchen einer beschriebenen Heizvorrichtung wird der Aescher auf 25° C. erwärmt, dann kommen die Häute hinein; sie bleiben in jedem ca. $1^1/_2$ Tag, wobei sie dreimal aufgeschlagen, bezw., wenn man sie in den Aescher gelegt hat (statt aufzuhängen), mehrfach getrieben werden und der Aescher wiederholt angewärmt wird. Der frische Aescher wird nun zum alten, der alte Aescher wird durch Zugabe von Kalk aufgebessert. Nach 6 bis 8 Wochen ist eine Reinigung erforderlich. Die Häute kommen nun zweimal in reines Wasser von 30° und zwar während 12—24 Stunden. Die Häute werden auf dem Baum gehaart, kommen dann 24 Stunden in frisches kaltes Wasser und werden dann geschoren. Nach 6—12stündigem Einlegen in lauwarmes Wasser werden sie mit dem Stein auf der Narbenseite bearbeitet und in dem Wasser, indem sie zuletzt gelegen haben, abgespült. Die Angerbung erfolgt in 12 Farben; die immer stärker werden; die oberste, frisch gestellte ist am stärksten; sie wird durch die nachrückenden Leder immer mehr geschwächt und schliesslich zur Eintreibfarbe. Die Angerbung dauert 3 Wochen. Die Brühen sind gerbstoffreiche Sauerbrühen, die durch Extraction des Versetzmaterials gewonnen werden. Das Eintreibgeschirr, in welches die Häute zuerst kommen, wird möglichst stets hierfür verwendet und enthält entweder eine Treibhaspel oder eine Treibtonne. In die folgenden 11 Geschirre werden die Häute eingehängt. Die beiden ersten Farben erfordern 2 Tage, jedes folgende einzeln 2 Tage. Die Häute werden bis zur vierten Farbe täglich dreimal, in den folgenden zweimal aufgeschlagen. Das zwölfte Geschirr wird jedesmal frisch gefüllt. Es folgen nun Versteckfarben; für leichtere Häute zwei, für schwerere drei, wobei teils saurer, teils süsser Extract zur Benutzung kommt. Eine Versteckfarbe ist ein Mittelding zwischen Farbe und Satz.

Die erste Versteckfarbe wird mit der Brühe aus der zweiten gefüllt; hierauf wird soviel frische Sauerbrühe aus der Versteckloh e hinzugegeben, dass die Grube halbvoll wird. Die Häute werden eingeworfen und je mit ca. 8 kg gemahlener Fichtenlohe bestreut. Die erste Versteckfarbe erfordert 8—12 Tage. Die Brühe kommt dann in die Farbe Nr. 12, die Lohe zum Auslaugen. Die zweite Versteckfarbe wird in analoger Weise mit der Brühe der dritten und frischer Sauerbrühe angestellt; jede Haut wird mit 10 kg Lohe bestreut. Dauer 2 Wochen. Die dritte Versteckfarbe wird mit Brühe aus den Sätzen und aus ausgelaugtem Versetzzeug halb gefüllt; jede Haut wird mit 12 kg Fichtenlohe bestreut, Dauer 3 Wochen.

Die nun folgende Grubengerbung weicht im wesentlichsten von der bisher angewandten ab. Man benutzte nämlich Valonea- und Knoppernmehl als Versetzzeug; das Mehl wird aber so schlecht ausgenutzt, dass es nach Gebrauch noch die Hälfte seines Gerbstoffgehaltes, nämlich

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16 Proc. Gerbstoff durchschnittlich enthält. Eichenrinde und Fichtenrinde nutzen sich in der Grubengerbung besser aus; sie enthalten ursprünglich ca. 8 Proc. Gerbstoff, von dem im Maximum 1/3 zurückbleibt. Ettner benutzt nun als Versetzzeug lediglich Fichtenrinde und benutzt als Zusatz starke frische Extracte aus Knoppern und Valonea. Die Fichtenrinde soll ausser als Streumaterial besonders als säurebildendes Material wirken. Man wendet ein bis drei Sätze an und benutzt per Haut und Satz 15 kg Rinde und 37½ l Extract. Das Extract zeigt 50° des Ettner'schen Brühenmessers, was bei reinem Valoneaextract einem Gerbstoffgehalt von ca. 6·7 Proc. entspricht. Dauer 6 Wochen. Die Brühe und auch der Extract aus dem Versetzzeug dient zur Anstellung der Versteckfarben.

Das ganze Verfahren dauert für ein- bis dreisätzige Terzen 13 bis 28 Wochen, was für Zahmsohlleder, überhaupt für Leder besserer Qualität keine zu lange Zeit ist. Man gebrauchte früher für einsätzige Terzen pro Haut 42 kg Lohe, 21 kg Valonea, für zweisätzige 52 kg Lohe, 38 kg Valonea, für dreisätzige 67 kg Lohe, 65 kg. Valonea, nach neuer Methode für einsätzige 33 kg Lohe, 9·4 kg Valonea, für zweisätzige 60 kg Lohe und 18·8 kg Valonea, für dreisätzige 75 kg Lohe und 26·9 kg Valonea (1 kg Valonea = 4 l Extract von 6·7 Proc. Gerbstoff) d. h. man erspart die Hälfte der teuren Valonea und gebraucht nur wenig mehr Lohe.

Zur Herstellung der Brühen dienen demnach drei Materialien, 1. die Sauerlohe aus den Versteckfarben, aus welcher man Brühen für das Zubessern der Versteckfarben und Angerbefarben erhält. 2. Das benutzte Grubenzeug; die daraus erhaltenen Brühen dienen für das Anstellen der Versteckfarben. 3. Frisches Knoppern- und Valoneamehl, woraus Extracte für das Abtränken der Gruben hergestellt werden. Die ersten beiden Brühen sollen möglichst stark gewonnen werden. Es werden hier 6 bis 8 Gefässe zu einer Batterie vereinigt. Man lässt die Brühe jeden Tag auf das nächstfolgende Gefäss steigen, wobei man auf das am meisten ausgelaugte Material heisses Wasser giesst, oder hier und in dem folgenden Gefäss die Auslaugung durch Erwärmen mittelst Dampfes unterstützt.

Für das Auslaugen von Valonea, Knoppern, Myrobalanen, die in Mehlform zur Verwendung kommen, dient ein von Gläser in Wien gebauter Apparat. Man erhält damit Extract mit bis 70 und darüber Graden des Ettner'schen Brühenmessers; man verdünnt sie für den Gebrauch mit Wasser oder besser noch mit Sauerbrühe, welche von dem Versteckzeug erhalten wurde, auf 50°. — Ettner bespricht dann den Uebergang von dem alten System in das neue und die Inbetriebsetzung einer neuerrichteten Gerberei. — Das aus der Grube gezogene Leder wird, um ein Nachdunkeln zu vermeiden, abgekehrt und auf der Narbenseite leicht eingefettet, am besten mit altem Fischtran. Man hängt die Häute zum Abwelken auf und stösst sie dann aus. Wird von den Consumenten der feine Belag, der sich jetzt auf den Valonea-Knoppernterzen befindet und besonders aus Ellagsäure besteht, verlangt, so stellt man Sauerbrühe von den Sätzen oder Extract von

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schlechter Valonea bezw. Valoneaeicheln mit etwas Schwefelsäure 8 bis 12 Tage an. Es bildet sich ein Bodensatz, der als Schlamm leicht auf die Narbe aufzutragen ist. Die Häute werden abgewelkt, gewalzt oder gerollt und in der Trockenstube getrocknet. — Man kann neben 1 Teil Valonea-Extract auch 1 Teil Extract aus Myrobalanen, Divi oder Knoppern verwenden.

In der Fabrik von Karl Budischowsky & Söhne ist seit vier Jahren die Extractgerberei eingerichtet; es werden wöchentlich 1000—1200 Büffelhäute für Sohl- und Brandsohlleder und 4000 Kipse neben etwas Kuh- und Kalboberleder hergestellt.

Der Farbstoff der Hemlockrinde oder Fichtenrinde wird bei Extraction in der Wärme gelöst, in der Kälte fällt er dann wieder aus. Wendet man daher wie bei der Hemlockgerbung zum Fertiggerben warme Brühen (von 25 bis 40°C steigend) an, so ist der Farbstoff noch gelöst, er geht in die Haut ein und vermehrt das Ledergewicht. Sadlon hat gezeigt, dass der Farbstoff in Borax löslich ist*) und Eitner teilt mit, dass auch kohlensaure Alkalien und andere alkalische Salze ein solches Lösevermögen haben (Gerber 8, 148). Derselbe schlägt nun vor, den sich aus heisser Brühe beim Erkalten niederschlagenden Farbstoff von der Brühe zu trennen und durch Zugabe von etwas doppelkohlensaurem Natron zu lösen, die Brühe für die Angerbung und die Farbstofflösung in einem späteren Stadium zu verwenden. — Den Farbstoff in der Brühe selbst durch Alkali in Lösung zu bringen, hält E. für unrationell, weil die Gegenwart alkalischer Salze die Aufnahme der wirklichen Gerbstoffe durch die Haut hindert. Dementsprechend können auch ältere Verfahren von Mountford und Loversidge, (Engl. P. 1915 vom 23. Juli 1866), wonach den Brühen von Valonea, Eichenrinde etc. Pottasche zugesetzt wird, und ein späteres Verfahren von Loversidge, (Engl. P. 148 vom Jahre 1867), welches Natron, Ammoniak oder deren Carbonate in Verbindung mit vegetabilischen Gerbstoffen anzuwenden empfiehlt, nach Eitner eher Schaden als Nutzen bringen.

Nach Loversidge in Rochdale (D. P. 18487) werden beim Gerben von Fellen und Häuten mittelst Valonea, Eichenrinde, Catechu und ähnlichen Gerbmaterialien den Bädern Borax oder Borsäure und für etwas schwere Häute ausserdem noch Citronensäure hinzugesetzt.

Nach dem V. St. P. 262516 von Turley in Council Bluffs soll der durch das Enthaaren in die Häute gebrachte Kalk mit einem Gemisch von Kohlensäure und gasförmiger schwefliger Säure neutralisirt werden. Die Gase werden durch Verbrennen von Kohle und Schwefel erhalten. Die Häute werden dann unvollständig gegerbt, nochmals mit den Gasen behandelt und fertig gegerbt.

Aufhellen lohgarer Schaffelle mit Lösung von Bleizucker und verdünnter Schwefelsäure, (Gerber 9, 101.)

Nach W. Eitner, (Gerber 8, 160) harzen alle Trane aus, weil sie verharzen und dabei ihr Volumen vermehren. Wallfischtran harzt rascher

*) Techn.-chem. Jahrb. 1883, S. 314.

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aus als Tran von Fischen (Dorsch, Häring, Sardellen, Thunfisch). Das Ausharzen des Tranes ist daher nicht von Verfälschungen desselben abhängig, wie man gewöhnlich glaubt. Das Ausharzen wird durch Wärme durch starkes Schmieren, wie es meist bei geschwärztem Leder erforderlich und, wie es scheint, auch durch manche Gerbstoffe (Fichten, Quebracho), sowie durch Traubenzucker befördert. Man verwendet nach E. am besten gar keinen Tran, sondern Vaselinöl.

Lackleder, Lackiren. J. H. Reinhardt in Würzburg will nach D. P. 19220 die Klebrigkeit des Lacks rasch dadurch beseitigen, dass die lackirten Gegenstände in geschlossenen Räumen der Einwirkung bewegter ozonisirter Luft ausgesetzt werden.

Günther in Berlin (D. P. 19267 vom 23. December 1881) stellt einen halbfesten Lederlack in folgender Weise her. Einer filtrirten Lösung von 80 Gewichtsteilen Schellack in 15 Gewichtsteilen Alkohol werden 3 Gewichtsteile Wachs und 2 Gewichtsteile Ricinusöl nebst Farbstoff zugesetzt. Das Ganze wird im Vacuum zur Syrupconsistenz eingedampft.

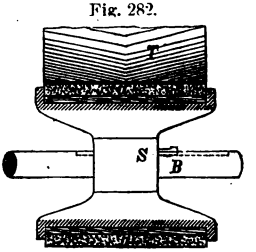
Product. Nach W. Eitner (Gerber 9, 31) erhält man aus Sohlleder, wenn man die löslichen Bestandteile mit Wasser auszieht, Gerbstoff mit Bleiessig fällt, und den Ueberschuss von Blei mit Schwefelwasserstoff ausfällt, eine Lösung, welche stets mit Fehling'scher Lösung die Zuckerreaction zeigt. Man erhält die Reaction auch mit Auszügen verschiedener Gerbematerialien und in verschiedenen Sauerbrühen. Es lässt sich also mit Fehling'scher Lösung nicht ohne weiteres ein betrügerischer Zusatz von Traubenzucker nachweisen.

Maschinen. Janson in London (D. P. 21266) hat die durch Patent 949, Heyl in Worms, geschützte Maschine zum Abfleischen, Abhaaren etc. so abgeändert, dass beide Seiten der Haut bezw. des Leders gleichzeitig bearbeitet werden können. — Lockwood in Boston, Maschine zum Windiren und Ausstossen, D. P. 17962.

Eine ziemlich einfache Lederschleifmaschine mit schnell rotirender Schleiftrommel und dagegen wirkendem Lineal ist von Gumpert in New-York und Koch in Berlin (D. P. 20965 vom 26. Mai 1882) angegeben.

Als Neuerung an Lederschleifmaschinen haben Metzger & Co. in Homburg v. d. Höhe (D. P. 20594 vom 14. März 1882, Fig. 282) unter der mit Schmirgelleinen überzogenen Schleiftrommel *T* den Schemel *S* angebracht, dessen Querdurchschnitt einem doppelten T ähnlich ist. Derselbe ist auf der Achse *B* drehbar und kann, nachdem die eine oder die andere Seite unter die Trommel gebracht ist, festgestellt werden. Auf der einen Seite dieses Schemels ist auf einer Holzunterlage eine Platte *a* aus weichem porösen Gummi befestigt, während auf der anderen Seite auf gleicher Unterlage eine Gummiplatte *b* aus härterem, weniger dem Druck nachgebendem

Fig. 282.



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Kautschuk angebracht ist. Will man leichteres bezw. dünneres Leder schleifen, so wird die Schemelseite mit der weichen Gummiplatte, bei stärkeren Sorten Leder die andere Schemelseite benutzt.

Ackermann in Darmstadt, (D. P. 19587 vom 18. Januar 1882.) Lederwalzwerk mit zwei stationären Rollen, von denen die obere nachgiebig und in regulirbarer Weise belastet ist.

Weissgerberei, Färberei. Eine eingehende Arbeit über Lammlederfabrikation findet sich in den Jahrgängen 1881 und 1882 des Gerbers.

Das englische Schafleder eignet sich besser zum Spalten als das deutsche. Doch wird bereits auch in Oesterreich gespaltenes Alaunleder aus heimischen Fellen erzeugt. (L. B. Goldschmid in Prag.) (Gerber 9, 114.)

Für Glacéleder-Gerbung und Färbung dürfen nur Gefässe von weichem Holz, am besten Tannenholz, niemals aber von Eichenholz verwendet werden, weil letzteres selbst nach der längsten Zeit noch Lohfleckung verursacht. (Gerber 9, 114.)

Zur Herstellung von Schafkid (Gerber 9, 3, 17, 30, 42, 53) eignen sich nur starke, faltenfreie, krätzereine Felle. Dieselben müssen sorgfältig beim Einkauf, dann aber nochmals aus dem Aescher sortirt werden. Beim Weichen muss der Erschlaffung möglichst entgegengewirkt werden, indem man die Weichzeit auf 2 Tage verkürzt und hartes Weichwasser anwendet, dagegen die Wirkung desselben durch Aufschlagen und Wiedereinlassen, durch Aufstrecken mit stumpfem Streckeisen und durch öfteren Wasserwechsel unterstützt. Es muss dabei die Wolle möglichst reingewaschen werden. Die Felle sollen dann 2 bis 3 Stunden abtropfen. Man darf beim Aeschern kein Arsenik zusetzen, jedoch ist kein zu alter Aescher zu verwenden. Durch stärkeren Aescher und tägliches Aufschlagen wird die Aescherzeit auf 10—12 Tage vermindert. Nach dem Entwollen folgt das Beschneiden, wobei die dünneren Partien möglichst zu schonen sind. Die Fälle werden trocken in die Eimer gegeben; sie erhalten dann die Narbenfaçon. Man stampft tüchtig ab, wäscht aus und giebt eine schnelle Mistbeize (3 bis 6 Stunden), wobei man zunächst auf 25° C. erwärmt und die Temperatur durch Ueberdecken möglichst erhält. Dann folgt die Fleischfaçon. Man stampft hierauf wiederholt und wäscht jedesmal aus, giebt dann eine Kleienbeize und macht nun gar, wobei man die Häute 2 mal 20 Minuten (mit Pause von 10 Minuten) in einer 2—300 Stück fassenden Trommel mit dem Garstoffe dreht. Dieser besteht aus Alaun, 3 bis 4 kg für 100 Felle, Salz, $^1/_3$ bis $^2/_5$ des Alauns, Mehl, 7·5 kg für 100 Felle und Eigelb, 1 Ei oder $^1/_{50}$·l Fasseigelb pro Fell. Man lässt die Felle mehrere Stunden oder über Nacht abkühlen und treibt sie dann nochmals 10 Minuten in der Maschine. Das Einfeuchten und Durchziehen lassen ist das bekannte. Man stollt, lässt durchziehen und schlichtet zweimal. Nach nochmaligem Sortiren werden die Felle in Façon geschnitten und dann brochirt.

Es wird nun mit Lösung von $^1/_8$ kg weisser Marseiller Seife, 6 Eidottern und 16·6 gr chromsaurem Kali in 4 l Wasser mehrmals gebeizt;

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man färbt mit mehreren Aufträgen von Blauholz und dunkelt durch Kupferwasser. Das Trocknen geschieht im Freien oder im Trockenzimmer unter 31° C. Nach 2 bis 3 Tagen werden die Felle durch Einpacken zwischen feuchten Sägespänen von Tannenholz gefeuchtet. Man streckt mittelst eines stumpfen Schlichtmondes auf der Fleischseite und schleift diese dann auf der Welle ab. Die Felle werden gründlich ausgetrocknet und hierauf im Schlichtrahmen mit halbscharfem Monde in die bekannte Façon der Kidleder gestrichen. Das Lüstern und Bügeln geschieht wie beim Kalbkid. Zunächst werden die Felle mit einem Lüster leicht überstrichen, der aus $^1/_2$ kg Gummi, $^1/_4$ kg gelbem Wachs, 0·38 kg Marseiller Seife, $^1/_4$ kg Talg in 5 l Wasser und event. etwas schwarzer Farbbrühe besteht. Die Felle werden mit dem Bügeleisen gebügelt und dann mit folgendem Lüster leicht gelüstert: 5 l Provenceöl, $^1/_4$ kg Gummi, $^1/_4$ kg gelbes Wachs, $^1/_4$ kg Harz, $^1/_4$ kg Talg, worauf durch Reiben mit Flanelllappen Glanz gegeben wird.

Hygienische Bestrebungen auf dem Gebiete der Lederindustrie von E. Simon in Haynau, ein kleines Werk, das besonders die Glacégerberei eingehend behandelt.

Beizmittel für Färberei. W. Eitner. (Gerber 9, 66, 77.) Für das Färben der Fleischseite genügt der im Leder vorhandene Alaun. Selbst wenn das Leder ordnungsmässig brochirt ist, wodurch der freie Alaun ausgewaschen wird, kann die Faser hier als genügend natürlich gebeizt betrachtet werden. Dasselbe gilt auch für die Plongefarben auf Glacé. Anders verhält es sich mit den Anstreichfarben des Narbens. Hier erweist sich Alaun als Beize unzureichend, man wendet gewöhnlich gefaulten menschlichen Urin an. Für hellere Töne wird derselbe verdünnt. Ist das Leder nicht genügend frei von überschüssigen fettigen und schmierigen Bestandteilen, so muss die Urinbeize mit einigen Tropfen Ammoniak, auch wohl mit etwas Salmiak verstärkt werden; event. kann man auch etwas Soda und Potasche hinzufügen. Für ganz grobnarbige, rauhe Felle eignet sich bei dunkler Farbe das doppeltchromsaure Kali als Zusatz zur Urinbeize, daneben kann etwas Marseiller Seife nebst einigen Eidottern beigerührt werden. Für Farben durch Indigo-Carmin, die alkalische Beizen nicht vertragen können, muss Alaun als Beizmittel genügen. Auch Pinkrinsäure kann als Beizmittel dienen. Die alkalischen Beizmittel und das chromsaure Kali dunkeln etwas die Farbe, sodass der Farbenton etwas dunkler ausfällt, als dies in Folge der natürlichen Eigenschaften der Farbstoffe geschehen sollte. Wenn man neben dem Effect des Beizens das Abdunkeln möglichst verhindern will, so müssen als Beize Salze von sehr schwach alkalischem Charakter gewählt werden; so eignen sich phosphorsaures Natron und Borax. Der Borax übertrifft vielfach die Urinbeize an Wirkung, er verhindert ausserdem die Fäulnis und das Schimmeln der Leder, so dass diese keine Stockflecke bekommen. Um die Farbtöne nicht zu dunkeln und um den gelben und roten Farben mehr Lebendigkeit und Feuer zu geben, wendet man neutrale und schwachsaure Beizmittel an, so einige weinsauren und citronensauren Salze,

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Hierher gehört auch der weisse Grund für Tafel- und Tunkfarben. Weinstein ist für Tafelfarben als Zusatz zur Urinbeize anwendbar. Zinkvitriol ist für Plongefarben zu benutzen; hier wird Zinkvitriol mit Borax gefällt, der Niederschlag jedoch mit Weinstein wieder in der Flüssigkeit gelöst. Die Lösung kann dann als Ueberstrich für gelbe Farben benutzt werden oder auch dem Urin hinzugesetzt werden. Weitere Beizwittel sind Zinnsalz und essigsaure Thonerde.

Bisher wird Handschuhleder durch Handarbeit mittelst Bürsten gefärbt. Joseph Kristen will dagegen nach D. P. 18019 vom 4. October 1881 (Gerber 8, 209) mittelst Centrifugalkraft färben, indem er das Fell in der Mitte einer horizontalen Scheibe befestigt und grundirt, dann die Scheibe schnell rotiren lässt und dabei die Farbe in der Mitte aufgiesst.

Mineralgerbung. Nach Harcke in Königslutter bei Braunschweig (D. P. 19633) wird Sohlleder in eine Lösung, welche aus einem Hartharz, besonders Colophonium, Steinkohlenkreosot oder Carbolsäure und Aetzkali oder Natronlösung in Wasser hergestellt ist, dann in die Lösung eines Thonerdesalzes, endlich in ein Bad von Eisenchlorid oder Eisenoxydsalz gebracht. Oberleder wird vorher gekälkt und sonst in gleicher Weise behandelt; soll dasselbe mehr weich und weniger wasserdicht ausfallen, so lässt man die Harzlösung bezw. den Harzzusatz fort. Man lässt ein Bad von Natriumthiosulfat folgen und wäscht aus.

Vanderstraaten in Jemappes (Oest. Ung. P. vom 6. Mai 1882) will bei der Mineralgerbung dadurch eine angehme Farbe der Leder erhalten, dass er diese zunächst mittelst vegetabilischer Gerbstoffe (Valonea oder $^1/_2$ Valonea, $^1/_2$ Mimosa) vorgerbt, dann mit mineralischen Gerbstoffen, besonders Kaliumbichromat durchgerbt und den Ueberschuss des letzteren durch eine Leimlösung (und Belichtung) unlöslich macht.

Sämischgerberei. Nach Gerber 9, 113 empfiehlt sich für Sämischgerberei nicht die Anwendung von Gift zum Enthaaren, weil dadurch die Aufnahme des Thranes erschwert wird.

Hieran mag sich ein eigentümliches Verfahren zur Gerbung bezw. Präpariren von Häuten für Handschuhleder von Johanna Josephi in Schwerin (D. P. 20250) anreihen. Danach werden leichte Tierfelle durch Kalk enthaart, abgespült und 24 bis 48 Stunden in Kalkwasser gelegt. Die Felle werden gereinigt, mit dem Bestossmesser bearbeitet, event. gewalkt und sauber abgespült. Sie kommen dann 6 Stunden und länger in Benzin (Naphta, Petroleumäther), werden darauf gepresst und getrocknet. Die nunmehr gegerbten Leder werden durch Schmieren, Abstossen, Krispeln, Närben etc. zugerichtet. Um fertige lohgarne Leder geschmeidiger und elastischer zu machen, werden sie in warmem Wasser aufgeweicht, in Benzin gelegt, getrocknet und geschmiert. Fischhäute werden geschuppt, etwas eingetrocknet, in warmem Wasser aufgeweicht, in Benzin gelegt und dann wie Leder behandelt. Därme werden in Salzwasser oder kochendes Wasser kurze

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Zeit gelegt, aufgeblasen, gereinigt und mit Benzin behandelt. Das Verfahren, nach dem wirklich gearbeitet wird, verdient eingehender studirt zu werden.

Kunstleder. Zur Darstellung von wasserdichtem Kunstleder aus Lederabfällen werden von Pollak in Wien (D. P. 18662) ungefettete Lederabfälle zunächst in einem dünnen Stärkekleister, der mit etwas Gummi arabicum und etwa 1 Proc. Alaun versetzt ist, geweicht, dann mit dickem Kleister einzeln bestrichen, in viereckigen Formen übereinander gelegt und durch Hämmern in Platten geklopft. Die Platten werden in eine Lösung von Natronseife gelegt und, nachdem sie durchfeuchtet, in der hydraulischen Presse comprimirt und getrocknet. Gefettete Abfälle werden zunächst in eine Wasserglaslösung, darauf in eine Lösung von schwefeligsaurem Zinkoxyd gelegt und dann gepresst. Die Abfälle werden dann mit Kleister bestrichen, zu Platten gehämmert und gepresst. An Stelle von Wasserglas können auch Alkalien angewendet werden, da nur das Fett in Seife überzuführen ist, welche nachher mittelst Zinkvitriols oder Alauns unlöslich gemacht wird.

Herstellung von künstlichem Leder aus Lederfasern, welche aus Lederabfällen gewonnen sind, und tierischen Sehnen von M. E. Cohn & Wollheim in Berlin und Wüstegiersdorf, Schlesien (D. P. 19616). Die Lederabfälle werden gewaschen und in ein Bad mit etwas Aetznatron oder Aetzkali gebracht. Nach dem Aufschwellen setzt man dem Bade doppeltkohlensaures Natron hinzu, um einer Gallertbildung des Leders vorzubeugen. Die Masse wird unter Schlagen gewaschen, im Zerreisswolf zerrissen, hierauf mit Wasser angerührt, sorgfältig mit Salzsäure neutralisirt und mit Wasser vollständig ausgewaschen. Andererseits werden getrocknete tierische Sehnen geklopft, auf einem Krempel zu einem wollähnlichen Stoffe zerrissen, kurze Zeit in ein Salzsäurebad gebracht und stark gepresst, wodurch die Sehnenwolle in einen leimähnlichen Zustand übergeht. Von der so vorbereiteten Sehnenwolle setzt man 5 bis 10 Proc. den Lederabfällen hinzu und verarbeitet das Ganze auf der Papiermaschine zu Tafeln. Auf dem Langsiebe werden beide Seiten der Tafeln mit einer Mischung aus gleichen Teilen einer concentrirten Alaun- und Kochsalzlösung besprengt, wodurch die Sehnenwolle wieder die faserige Textur annimmt und dabei die Lederfasern verkittet. Das Fabrikat wird auf einer Seite mit einer Lösung von Kautschuk in Schwefelkohlenstoff bestrichen, worauf diese Seite durch Närben etc. ein lederähnliches Ansehen erhält.

Wolff in Mannheim will nach D. P. 20483 den bei der Reinigung des Baumwollensamenöls verbleibenden trockenen pulverförmigen Rückstand da durch zu einer lederähnlichen Masse verarbeiten, dass er ihn mit Fetten, Oelen, Paraffin, Ceresin, Wachs, Harz etc. und andererseits mit Graphit, Zinnober, Russ etc. mischt, [Schwefel [hinzusetzt] und längere Zeit auf 80—150° C. erhitzt.

Arthur Lehmann.

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Statistik.

Im Deutschen Reich betrug in metr. Centnern ausgedrückt, die

Waarengattung	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
Holzborke und Gerberlohe . . .	592 639	570 942	45 989	45 605
Leder	33 431	36 491	49 160	47 590

XXXI. Leim.

Lederleim. Bei der Lederleimfabrikation verfährt man bekanntlich so, dass man die tierischen Abfälle, wesentlich die bei dem Ausfleischen und Beschneiden gekälkter Häute abfallenden Stücke, noch weiter mit Kalkmilch behandelt, dann trocknet und nun auf Leim kocht. Nach dem Abziehen der Leimbrühe bleiben in dem Kocher Rückstände, die in Haufen gesammelt und als Dünger verwendet werden. Sehr bald gehen dieselben jedoch in Fäulnis über, sodass schon nach 24 Stunden ihre Handhabung und ihr Transport sehr unangenehm wird. Leblanc frères in Lyon haben nun gefunden, dass diese Abfälle beträchtliche Mengen von Fettsäuren in Form unlöslicher Kalkseifen enthalten und dass man diese Fettsäuren gewinnen und zugleich einen wertvollen Stickstoffdünger erhalten kann, wenn man die Abfälle mit Schwefelsäure macerirt und dann auspresst. Der Pressrückstand bildet den Dünger. Aus der ausgepressten Flüssigkeit scheiden sich die Fettsäuren oben ab. (D. P. 23779.)

Knochenleim. H. Ohlert in Kowno (D. P. 19479) will die gedämpften Knochen darren, um die Leimbildung zu befördern. Nach dem Darren werden die Knochen gemahlen, wobei aber von den entstandenen Producten das Schrot auf Knochenkohle verarbeitet und das Mehl als Düngemittel verwendet, und nur die Grütze auf Leim gekocht wird. Dieselbe wird in einen Topf gefüllt, der einen durchlöcherten Boden hat. Dieser wird in einen mit Dampfmantel versehenen Kocher gehängt, welcher teilweise mit Wasser oder im Verfahren gewonnener dünner Leimbrühe gefüllt wird. Der Topf füllt den Kocher fast ganz aus, so dass das Wasser über den oberen Rand des Topfes überkocht und so fortwährend durch die Grütze circulirt. Beim Filtriren durch die Knochengrütze wird so die Leimbrühe geklärt. Nachdem die starke erste Brühe abgelassen ist, wird frisches Wasser in den Kocher gegossen und weiter gekocht, bis die Extraction beendigt ist. Man hebt alsdann den Topf bis über den Kocher und giesst etwas Wasser auf, das auch noch in den Kocher filtrirt. Hierauf wird der Einhängetopf entleert, mit frischer Grütze gefüllt und in die schwache Leimlösung gehängt, so dass der Process von neuem beginnt.

Die Fabrikation von Knochenleim unter Benutzung flüchtiger

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Lösungsmittel für das Fett macht in Deutschland weitere Fortschritte. Insbesondere scheint das Verfahren von Leuner*) Anklang zu finden.

Die neueren Bestrebungen in Ausbildung der Extraction mit Benzin etc. gehen nun besonders dahin, in dem Extractor vor Einlassung des Benzins ein Vacuum zu erzeugen, um Luft etc. aus den Knochen zu entfernen. Für diesen Zweck combiniren Wellstein und Birkenheuer (D. P. 19774) mit dem Extractor einen grösseren Behälter, der mit Kühlmantel umgeben ist. Um die Luft aus dem Extractor auszutreiben, wird in dem Behälter durch Einleiten von Dampf und folgendes Einspritzen von Wasser ein Vacuum erzeugt und dann der Behälter mit dem Extractor verbunden, wobei sich der Luftdruck in beiden Gefässen ausgleicht. Dies wird einige Mal wiederholt. Nach Prospecten von Neumeyer in Nürnberg wird jedoch zum Luftleermachen jetzt ein Dampfstralsauger und das erwähnte Gefäss als Kühler benutzt.

Hirzel in Plagwitz-Leipzig (D. P. 19588) sucht die Durchdringbarkeit der Knochen für das Lösungsmittel durch eine möglichst vollkommene Trocknung derselben zu steigern. Der Behälter, in welchen die Knochen kommen, ist hermetisch verschliessbar, durch Dampf heizbar, mit einem Kühlapparate und mit Absorptionsgefässen, die mit Schwefelsäure gefüllt sind, versehen. Es wird mittelst einer Luftpumpe ein Vacuum hergestellt, so dass bei fortwährendem Erwärmen, und indem die verdampfende Feuchtigkeit durch die Schwefelsäure absorbirt wird, die Knochen rasch getrocknet werden. Man lässt dann nach Aufhebung des Vacuums die Extractionsflüssigkeit (Schwefelkohlenstoff z. B.) zu und erwärmt gelinde, lässt dann die Fettlösung in einen Destillationsapparat abfliessen. Um die Reste des Lösungsmittels aus den entfetteten Knochen zu verjagen, lässt man einen kräftigen Dampfstral zutreten und condensirt die Dämpfe des Lösungsmittels im Kühler. Dann lässt man den langsamer eintretenden Dampf am oberen Teil des Behälters sich condensiren. Das heisse Wasser extrahirt dann den Leim aus den Knochen.

Zur Extraction der Knochen durch Benzin unter Druck ist von Schneider in Lehrberg bei Ansbach (D. P. 22295) folgendes Verfahren angegeben. Es wird in dem Extractor Benzin verdampft, bis solches nach dem Condensator überzudestilliren anfängt, der Inhalt des Extractors somit bis auf den Siedepunkt des Benzins erwärmt ist. Hierauf wird flüssiges Benzin eingebraust und zwar mit einem Ueberdruck von 1 Atm. Nach einiger Zeit wird das Benzin im Extractor verdampft und dann wieder flüssiges Benzin eingebraust, jedoch mit stärkerem Ueberdruck. Dies wiederholt man nochmals und wendet schliesslich für das Einbrausen einen Ueberdruck von 2 Atm. an. Die Brausen befinden sich oben und auch seitlich im Extractor.

Leimtrocknungsapparat. Ein solcher ist von Scheidemantel in Landshut, Bayern (D. P. 17365) construirt. Bei demselben wird eine mit den Leimrahmen bepackte Wagenreihe durch einen Canal geschoben, während ihr passend erwärmte Luft entgegenströmt.

Leimpräparate. Zur Conservirung von Leimgallerte nach

*) Techn.-chem. Jahrb. 1883. S. 308.

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Horadam in Düsseldorf (D. P. 22269), erhält dieselbe einen Zusatz von 8 bis 10 Proc. Chlorcalcium oder Chlormagnesium, wodurch die Fäulnis verhindert wird. Die Bindekraft des Leims soll dadurch nicht beeinträchtigt werden. Bei Zusatz von 30 Proc., auf das Trockengewicht des Leims bezogen, erhält man flüssigen Leim von grosser Haltbarkeit.

Unter der Bezeichnung „chemischer Malerleim" wird von Betz in Karlsruhe ein mit Wasserglas versetzter Leim in den Handel gebracht. (Pap.-Ztg. 1882, S. 1394.) Arthur Lehmann.

Statistik.

Im Deutschen Reich betrug in metr. Centnern ausgedrückt, die

Waarengattung	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
Gelatine und Leim	15 966	16 939	28 929	31 290

XXXII. Farbstoffe.

I. Unorganische Farbstoffe und Anstriche.

Rud. Horn in Düsseldorf hat einen Waschapparat zur Trennung des Bleiweiss von unangegriffenem Blei angegeben. (D. P. 19401.)

T. H. Cobley in Dunstable. Fabrikation von mineralischen weissen Stoffen. (Engl. P. 5155 vom 25. November 1881, D. P. 21587.) Eine Lösung von Magnesiumsulfat wird mit Kalkmilch gefällt. Der Niederschlag von Magnesia nnd Calciumsulfat soll in der Papierfabrikation und zum Beschweren von Textilstoffen dienen. Für die Papierindustrie soll sich besonders das aus Magnesiumsulfat mittelst Chlorcalcium gefällte Calciumsulfat eignen. Die Lösung von Chlormagnesium wird mit Kalk gefällt, nachdem vorher 10 Proc. Aluminiumchlorid zugesetzt sind. Der Niederschlag soll besonders geeignet sein, um die Entstehung von Mehltau auf Webstoffen zu verhindern.

Edw. A. Parnell in Swansea. Fabrikation von Eisenoxyd (Kolkothar). (Engl. P. 4201 vom 29. September 1881.) Dem Eisen- (Ferro- und Ferri-) Sulfat wird vor dem Erhitzen soviel eines Reductionsmittels zugemischt, dass die Schwefelsäure in schweflige Säure übergeführt wird, ohne dass aber das Eisenoxyd wesentlich verändert wird. Die Zersetzung des Eisensulfats geht dann bei viel niedrigerer Temperatur vor sich, als ohne diesen Zusatz. Als Reductionsmittel werden Schwefelkies (1 Tl. auf 10 wasserfreies Sulfat für Hellrot, 1:8 für Dunkelrot) oder Kohle (1:30) oder auch Gase wie Schwefelwasserstoff empfohlen. — Der Erfinder beansprucht auch als neu die Verarbeitung der Lösung, welche in der Weissblechfabrikation beim Beizen des Eisens mit Salzsäure abfällt, deren Verdampfung zur Trockne und Zersetzung des Eisenchlorids im Dampfstrom in Salzsäure und Eisenoxyd.

G. Guckelberger sucht zu beweisen, dass die verschiedenen Arten

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Ultramarin am besten von einer typischen Formel abgeleitet werden können, welche Si^{18} enthält. Für wenig Si enthaltendes Ultramarin giebt er die Formel $Si^{18}Al^{18}Na^{20}S^6O^{71}$; für Si-reiches Ultramarin $Si^{18}Al^{12}Na^{20}S^6O^{62}$. (Lieb. Ann. **213**, 182, 252.)

Fritz André Quentin van Gelder in Delft hat folgenden Oelanstrich patentirt. (D. P. 21911.) Eine Lösung von Zinkacetat wird mit Wasserglas gefällt. Der ausgewaschene, noch etwas feuchte Niederschlag von Zinksilicat wird erst mit Leinöl, dann mit Zinkweiss und Terpentinöl zusammengerieben.

J. G. Sponnagel und Rich. Jacobsen in Berlin stellen mit Wasser verdünnbare aber nach dem Trocknen unlösliche Farbbindemittel her. (D. P. 20281 vom 21. April 1882.) Trocknende Oele und Harze oder Wachsarten werden mit Alkali verseift. Oder die genannten Stoffe werden unter Erwärmung mit 5 bis 10 Proc. phosphorsaurem Natron zu einer Emulsion zusammengerührt. In den Seifenleim oder in die Emulsion wird alsdann Caseïn eingerührt. Die dickflüssige Masse wird vor dem Gebrauch stark mit Wasser verdünnt und mit Körperfarben vermischt. Der nicht glänzende Anstrich mit solcher Farbe trocknet schneller als Oelfarbenanstrich und ist wetterbeständig.

Henry Knight in Liverpool stellt eine weisse Anstrichfarbe (Engl. P. 795 vom 18. Februar 1882) her, indem Zinksalze mit Strontiumverbindungen gefällt werden, wobei man so verfährt, dass sich auch Chlornatrium bildet, oder zugegen ist, welches, zum Teil bei dem Niederschlag bleibend, diesen bei der Calcination angeblich vor Entfärbung schützen soll.

Ein fäulniswidriger Anstrich von Harrey in Glasgow für Schiffsböden besteht aus 45 Tln. Naphta, 32 Tln. Colophonium, 12 Tln. Terpentin, 10 Tln. Leinöl. Der Masse kann noch arseniksaures oder chromsaures Quecksilber zugesetzt werden.

Der von Horst in Linz a. Rh. patentirte desinficirende Anstrich (D. P. 19217 vom 6. Januar 1882) besteht aus: 5 bis 10 Tln. Carbolsäure, 15 Tln. Braunstein, 10 Tln. Chlorcalcium, 50 Tln. China Clay oder ähnlichen indifferenten Stoffen, 20 Tln. Infusorienerde und 10 Tln. Dextrin oder Gummi arabicum.

Eine feuerfeste Asbestfarbe von Kothe in Deutz (D. P. 20937 vom 7. Februar 1882) besteht aus einer Mischung von Asbeststaub (30 Proc.), mit Thon (20 Proc.) und Wasser (30 Proc.), Borax (10 Proc.) und Wasserglas (10 Proc.), wobei eine Farbe zugesetzt werden kann.

Riegelmann in Hanau bereitet Anstrichfarben zum Schutz gegen Rost folgendermaassen. (D. P. 19642 vom 10. Februar 1882.) Der gewöhnlichen Leinölfarbe werden 10 Proc. gebrannte Magnesia, Baryt oder Strontian kalt zugemischt, ferner Mineralöl, um die alkalischen Erden einzuhüllen. Dadurch sollen nicht nur freie Säuren der Farben neutralisirt werden, sondern infolge dauernder alkalischer Reaction auch das Eisen vor Rost geschützt werden. Um Eisen in der Erde rostfrei zu erhalten, wird es mit einem Gemisch von 100 Tln. Fichtenharz, 25 Guttapercha, 50 Paraffin, dem 20 Tle. Magnesia nebst Mineralöl zugesetzt ist, bestrichen. — Dem 20 bis

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30 Proc. Magnesia oder gebrannten Dolomit enthaltenden Anstrich für Maschinenteile, wird damit derselbe nicht eintrockne, Vaseline zugesetzt. — Papier oder Zeug, welches zur Verpackung blanker Eisenwaaren dienen soll, wird auf der einen Seite mit der eben erwähnten Mischung bestrichen, auf der andern durch Auftragen von Chromleimlösung wasserdicht gemacht.

Gehring in Landshut stellt eine wasserdichte Anstrichmasse für Steine, Verputz, Pappe, Metalle, Holz und Textilstoffe her (D. P. 19298) durch Zusammenschmelzen von 60 Gwtln. Paraffin, 30 Gwtln. palmitinsaurer Thonerde (durch Fällen einer Lösung von Palmölseife mit Alaunlösung erhalten) und 15 Gwtln. Wachs. Die zu imprägnirenden Gegenstände werden auf 60 bis 90° erhitzt und dann mit der geschmolzenen Masse bestrichen. Für geringe Gegenstände kann das weisse Wachs durch gelbes, zum Teil auch durch Colophonium ersetzt werden. Zum Bestreichen von Textilstoffen wird eine Mischung von 60 Paraffin, 20 palmitinsaurer Thonerde und 10 bis 15 gelbem Wachs in Leinölfirnis gelöst, dem 6 bis 15 Proc. Terpentinöl zugesetzt werden.

Nach dem D. P. 20725 von G. werden gleiche Teile palmitinsaure Thonerde und Colophonium oder palmitinsaure Thonerde und Wachs gemischt und in Natronlauge gelöst. Es entsteht eine seifenähnliche Lösung, mit der man die Mauern etc. bestreicht oder tränkt. Nach dem Trocknen des Anstriches wird derselbe mit einer schwachen Lösung von schwefelsaurer Thonerde abgespült und hierdurch unlöslich gemacht.

Adolf Keim in München. Herstellung wetterbeständiger Wandgemälde und flammensicherer Theaterdecorationen (D. P. 19210 und 21874). Der Untergrund wird aus einem Mörtel von Kalk, Sand, Infusorienerde und Wasser hergestellt, der Malgrund aus 4 Raumteilen Quarzsand, $3^1/_2$ Marmorsand, $^1/_2$ Infusorienerde, $1^1/_2$ Kalkbrei. Nach dem Trocknen wird derselbe mit Kieselfluorwasserstoffsäure überstrichen und wiederholt mit Kaliwasserglas imprägnirt. Als Farben dienen Erdfarben, die längere Zeit mit Kaliwasserglas digerirt worden sind. Die Kieselsäure wird dann mittelst Ammoniumcarbonats ausgeschieden und bleibt mit den Farben gemischt. Die ausgewaschenen Farben werden dann noch mit Thonerde- und Magnesiahydrat gemischt. Die Bilder werden mit einer Flüssigkeit imprägnirt, die Kaliwasserglas, Ammoniak und Aetzkali enthält. Nach dem Fixiren werden sie mit kohlensaurem Ammoniak, dann mit Wasser gewaschen und schliesslich mit einer Lösung von Paraffin in Petroleumäther imprägnirt. Die Farben erhalten nach D. P. 21874 noch Zusätze von Flussspath Zinkoxyd, Marmor, Glaspulver, Braunstein oder Bariumcarbonat. Diese Körper haben eine grosse Bindungsfähigkeit für kieselsaures Alkali, ohne starke Deckkraft zu zeigen. Ein Verfahren zur Präparirung von Malerleinewand besteht darin, dass dieselbe mit einer Lösung von Magnesiumsulfat, Aetzbaryt, Wasserglaslösung und Kieselfluorwasserstoffsäure getränkt und hierauf mit dem Malgrunde, bestehend aus Bariumcarbonat, Marmor und Kaliwasserglas versehen wird. Diese Leinewand bleibt rollbar und ist flammensicher. Die in der

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Leinwand erzeugten Stoffe bilden durch mehrfache Doppelfällung unter Einwirkung des Barytwassers auf die schwefelsaure Magnesia, auf und in der Faser, einen Niederschlag von schwefelsaurem Baryt und Magnesiahydrat, welches letztere dann mit dem Wasserglas ein Magnesiasilicat bildet. Durch die Einwirkung der Kieselfluorwasserstoffsäure auf das Wasserglas bildet sich unter Ausscheidung von Kieselsäure mit dem Kali des Wasserglases Kieselfluorkalium, welches im Wasser äusserst schwer löslich ist und keine zerstörende Wirkung auf die Farben auszuüben vermag. Die Imprägnirungsmasse zeigt schliesslich weder saure noch alkalische Reaction, so dass weder auf die Farbe noch auf die Leinwand eine nachteilige Einwirkung stattfindet. Bei Brandschaden äussern diese durch Feuer unzerstörbaren und unzersetzbaren Producte keinerlei schädliche Wirkung durch giftige Gase oder Dämpfe und erzeugen keinen Rauch.

Sulliot und David in Paris. Verfahren, Gewebestoffe, Theaterdecorationen etc. unverbrennlich zu machen. (D. P. 20800 vom 7. Januar 1882.) Die Gewebe, Theaterdecorationen etc. werden mit Lösungen imprägnirt, welche Verbindungen des Zuckers mit Calcium-, Natrium, Magnesium-, Aluminium-, oder Ammoniumborat, bezw. -Phosphat-, Silicat oder -Wolframat und geringen Mengen einer Säure wie Phosphorsäure, Kieselsäure oder Wolframsäure enthalten.

H. Günther in Berlin. Schwarze Buchdruckfarben*) (D. P. 16905 vom 2. Juli 1881) bestehen aus 45 Tln. Anthracenöl (*green oil*), welches mit 5 Proc. Kupferchlorid gekocht worden ist, 40 Tln. Pech oder Asphalt, 12 Tln. Schmierseife, 5 bis 8 Tln. Thran und 3 bis 15 Tln. alkohollöslicher Anilinfarbe. — Ein Lederschmieröl besteht aus Anthracenöl und 15 Proc. Thran. — Um den unangenehmen Geruch des Anthracenöls zu beseitigen, behandelt man dasselbe bei einer Temperatur von über 100° mit Chlorgas oder Salpetersäure.

H. Brackebusch in Berlin (D. P. 16227) verwendet statt des gebräuchlichen Leinölfirnisses eine Auflösung von 40 bis 45 Tln. Colophonium in 25 Tln. Paraffinöl zur Herstellung von Buchdruckfarben.

W. Reissig in München setzt der aus Leinfirniss und Russ bestehenden Drucker- und Stempelschwärze Eisenoxyd- oder Eisenoxydulverbindungen oder metallisches Eisen zu. Diese gehen mit der Cellulose und der Leimung des Papiers eine innige Verbindung ein, in welcher das Eisen dann noch sicher nachzuweisen ist, wenn die Schwärze einer Defraudation wegen völlig beseitigt ist (D. P. 17462).

Die Druckerschwärze von Schmidt in Bockenheim (D. P. 21408 vom 20. Juni 1882) enthält neben dem Leinölfirnis nicht Kienruss, sondern Mangansuperoxyd. Mit dieser Schwärze bedruckte Maculatur kann wieder zur Herstellung weissen Papiers verwendet werden, da das Mangansuperoxyd leicht zu beseitigen ist.

*) Techn.-chem. Jahrb. 1881, S. 270; 1882, S. 371.

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II. Teerfarben.

I. Rohstoffe und Zwischenproducte.

Einen bisher stets übersehenen Bestandteil selbst des reinsten **Steinkohlenteer-Benzol's** hat V. **Meyer** aufgefunden. Als er solches Benzol mit einer Lösung von Isatin in concentrirter Schwefelsäure schüttelte, erhielt er eine prachtvolle tiefblaue Färbung, welche von der Bildung des von **Baeyer** beschriebenen Indophenin herrührte (Ber. chem. Ges. 15, 2898). Später fand **Meyer**, dass diese Reaction von einem dem Teerbenzol stets beigemengten **schwefelhaltigen** Körper herrührt, den er **Thiophen** genannt hat.

Das Teerbenzol enthält immer etwa 0·5 Proc. dieses Körpers, welcher dem Benzol in seinen Eigenschaften sehr ähnlich ist, bei 84° siedet und die Indopheninreaction liefert. Die Methode der Isolirung des Thiophens aus dem Teerbenzol gründet sich auf seine Eigenschaft, durch concentrirte Schwefelsäure in Form einer Sulfosäure fixirt zu werden. 250 l reinstes Handelsbenzol wurden mit 25 l concentrirter Schwefelsäure 4 Stunden lang geschüttelt, das aufschwimmende Benzol wurde entfernt, die schwarze Säureschicht mit Wasser verdünnt und in das Bleisalz übergeführt. Es wurden 16 kg des rohen Bleisalzes der Sulfosäure erhalten. Das Bleisalz wird mit $^1/_4$ seines Gewichts an Salmiak destillirt. Das Rohdestillat, welches reichlich Mercaptan enthält, wird durch Schütteln mit Wasser, dann mit Kalilauge gereinigt, durch Chlorcalcium entwässert und destillirt. Das entwässerte Oel siedet grösstenteils bei 84°, enthält 70 Proc. des neuen Körpers und 30 Proc. Benzol. Je 1 kg Bleisalz lieferte ca. 80 g dieses Oeles. Dies Rohthiophen (1 Vol.) wird mit 100 Volumteilen Ligroin verdünnt und mit 10 Vol. concentrirter Schwefelsäure so lange geschüttelt, bis eine Probe der Ligroinschicht die Indopheninreaction eben nicht mehr zeigt. Die vom Ligroin getrennte schwarze Thiophensulfosäure wird mit Wasser verdünnt, in das Bleisalz verwandelt, letzteres mittelst Schwefelwasserstoff zersetzt. Die freie Thiophensulfosäure, trocken destillirt, liefert reines Thiophen; noch zweckmässiger erhält man dieses durch Destillation der Sulfosäure mit Salmiak.

Thiophen bildet ein wasserhelles, leicht bewegliches Oel vom Siedepunkt 84° (corr.) und vom spec. Gew. 1·062 bei 23° C. Es hat die Zusammensetzung C^4H^4S, mischt sich nicht mit Wasser, bleibt bei stundenlangem Kochen über Natrium unverändert.

Durch Behandlung des Thiophens — auch des mit Benzol verunreinigten Rohthiophens — mit Brom wird ein Mono- und ein Dibromthiophen erhalten. Monobromthiophen C^4H^3BrS siedet bei 149—151° (uncorr.), hat das spec. Gew. 1·652 bei 23° und gleicht in seinen Eigenschaften sehr dem Monobrombenzol. Das in weit grösserer Menge entstehende Dibromthiophen $C^4H^2Br^2S$ bildet ebenfalls ein farbloses, lichtbrechendes Oel, welches bei 210·5 bis 211° (corr.) siedet, vom spec. Gew. 2·147 bei 23°. Thiophen liefert beim Schütteln mit Isatin und concentrirter Schwefelsäure sofort in intensivster

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Weise das blaue Indophenin. Die gebromten Thiophene liefern ebenfalls, wenn auch langsamer, eine blaue Reaction.

Baeyer hat hierauf gefunden, dass die von V. Meyer ausgesprochene Vermutung, das Indophenin sei ein schwefelhaltiger Körper, in der That richtig sei. Es bildet sich aus 1 Mol. Isatin und 1 Mol. Thiophen

$$C^8H^5NO^2 + C^4H^4S = C^{12}H^7NOS + H^2O.$$

Die früher (Ber. chem. Ges. 12, 311) für das Indophenin angegebene Formel $C^{20}H^{15}NO$ ist also zu cassiren. (Ber. chem. Ges. 16, 1478.)

Leo Lewy in Mannheim hat ein Verfahren zur Trennung von Paratoluidin und Orthotoluidin, sowie des Anilins und Paratoluidins vom Orthotoluidin angegeben. (D. P. 22139 vom 26. Juli 1882.) Während beim directen Sättigen der genannten Basen mit Phosphorsäure oder Arsensäure Salze von ungefähr denselben Löslichkeitsverhältnissen sich ergeben, treten bedeutende Unterschiede auf, wenn diese Salze durch doppelte Zersetzung dargestellt werden. Salzsaures Anilin und salzsaures Paratoluidin zersetzen sich mit dem secundären Natriumphosphat so, dass die secundären Phosphate der Basen entstehen, also $(C^6H^5NH^2)^2HPO^4$. Salzsaures Orthotoluidin liefert dagegen unter gleichen Umständen zu 80 Proc. freies Orthotoluidin, zu 20 Proc. saures phosphorsaures Ortholuidin:

1) $C^7H^7.NH^2.HCl + Na^2HPO^4 = NaCl + NaH^2PO^4 + C^7H^7.NH^2$

2) $C^7H^7.NH^2.HCl + NaH^2PO^4 = NaCl + (C^7H^7NH^2)\,H^2PO^4$.

Man versetzt also das Gemisch der salzsauren Salze der Basen mit einer Lösung von Natriumphosphat bringt den entstehenden Krystallbrei durch Erwärmen in Lösung und hebert die obenauf schwimmende Oelschicht von Orthotoluidin ab. Beim Erkalten krystallisiren die Phosphate des Anilins und Paratoluidins vollständig aus, während das Orthotoluidinsalz gelöst bleibt. Phosphorsaures Natrium gewinnt man bei der Abscheidung der freien Basen immer wieder. Ebenso verhält sich arsensaures Natrium. Man kann auf diese Weise reines Para- und Orthotoluidin aus gewöhnlichem Toluidin, ferner Orthotoluidin, Safraninöl und „Anilin für Rot“ aus den Echappés gewinnen.

Wilhelm Staedel in Darmstadt hat ein Verfahren zur Darstellung der mono- und di-alkylirten Abkömmlinge des Anilins und des Toluidins angegeben. (D. P. 21241 vom 3. Februar 1882.) Erhitzt man je ein Molecül der Bromhydrate des Anilins, seiner Homologen oder der Substitutionsproducte dieser Körper mit je einem Molecül nebst ca. 10 Proc. Ueberschuss Aethylalkohol, während 8 bis 10 Stunden in Autoclaven aus 145 bis 150° C., so entstehen glatt, und meistens fast ganz ohne Nebenproducte, tertiäre Basen, wie beispielsweise Diäthylanilin. Wendet man die bezeichneten Bromhydrate und Alkohole in molecularen Verhältnissen an, so erhält man bei derselben Temperatur Gemische primärer, secundärer und tertiärer Basen, in welchen die secundäre Base der Menge nach vorwaltet.

Die Ausbeuten an tertiären Basen bei ersterem Verhältnis schwanken je nach der Natur der Base und des Alkohols, von denen man ausging,

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zwischen 80 und 99 Proc., die der secundären Basen beim zweiten Verhältnis zwischen 35 und 55 Proc. der theoretischen Ausbeute. Noch leichter, nämlich bei 125 bis 130° C., gehen die beschriebenen Reactionen unter Anwendung der Jodhydrate der bezeichneten Basen an Stelle der Bromhydrate vor sich. Die durch Alkalien oder Kalk aus den Reactionsproducten des ersten Mischungsverhältnisses abgeschiedenen tertiären Basen werden durch Destillation rein gewonnen.

Bei diesem Verfahren lassen sich die äthylirten Producte unter Anwendung einer viel niedrigeren Temperatur als bei dem seither üblichen Verfahren herstellen. Dabei werden die Basen in grösseren Ausbeuten erhalten als seither; so wird beispielsweise das Diäthylanilin nach dem oben beschriebenen Verfahren mit 95 bezw. 98 Proc. der theoretischen Ausbeute direct rein gewonnen.

Edward D. Kendall in Brooklyn. Darstellung von Anilin und Toluidin, sowie von Farbstoffen daraus patentirt. (Engl. P. 384 vom 25. Jan. 1882; D. P. 21131.) Dies Patent betrifft die zuerst von Goppelsröder*) angegebene Darstellung von Anilin und Teerfarbstoffen auf elektro-chemischem Wege. Das Verfahren besteht wesentlich darin, Nitrobenzol und Nitrotoluol in einer porösen Zelle in verdünnter Schwefelsäure oder Salzlösung der Einwirkung eines von einer Batterie oder einer dynamoelektrischen Maschine erzeugten elektrischen Stromes auszusetzen. An der negativen Elektrode wird durch den nascirenden Wasserstoff Anilin bezw. Toluidin gebildet. Wenn letztere Körper der Wirkung der positiven Elektrode der Batterie ausgesetzt werden, so scheidet sich hier ein fester Farbstoff ab. Man bringt Nitrobenzol etc. in ein poröses Gefäss, das eine Mischung von Wasser und Schwefelsäure oder salzhaltiges Wasser enthält und mit der negativen Elektrode der Batterie oder Leitung verbunden ist. Das Wasser wird zersetzt und der frei werdende Wasserstoff verwandelt das Nitrobenzol in Anilin etc. Es ist vorteilhaft, der negativen Elektrode *B* eine Auf- und Abwärtsbewegung in dem porösen Einsatz *A* zu erteilen, weil dadurch eine innige Mischung der in dem Gefässe befindlichen Stoffe und die Berührung des Nitrobenzols mit dem Wasserstoff in dem Moment, wo der-

Fig. 283.

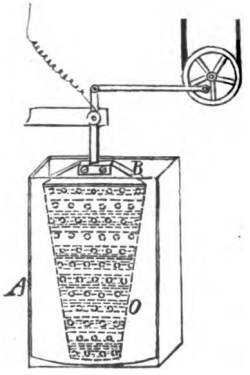
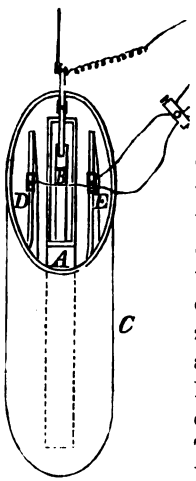


Fig. 284.



*) Techn.-chem. Jahrb. 1883, S. 382.

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selbe abgeschieden wird, hervorgebracht wird. Um diese Verbindung noch sicherer zu machen, ist die Kohlen-Elektrode mit einem Ueberzug *O* von Zeug oder anderem Faserstoff versehen, dessen unteres Ende in die flüssigen Nitrokohlenwasserstoffe eintaucht und dieselben beim Vibriren jedesmal an den Flächen der Kohlenplatte emporhebt, wo sie dann unter Einwirkung des Stromes mit dem frei werdenden Wasserstoff innig gemischt werden. In diesem Zeugüberzuge können noch Löcher angebracht werden, um eine freie Circulation der Flüssigkeit in dem porösen Gefäss zu gestatten. *D* und *E* sind die positiven Elektroden.

Die Actiengesellschaft für Anilinfabrication in Berlin stellt festes Cumidin in folgender Weise her. (D. P. 22265 vom 1. Juli 1882; vgl. Hofmann, Ber. der chem. Ges. XV., 2895.) Das nach Hofmann durch Digestion von salzsaurem Xylidin mit Methylalkohol im Autoclaven bei 280° C. erhaltene rohe salzsaure Cumidin wird in Nitrat umgewandelt. Das schwer lösliche Nitrat wird auf einer Centrifuge von der anhängenden Mutterlauge befreit und mit etwas Wasser gewaschen. Man erhält ein feines Krystallmehl von Nitraten der verschiedenen Modificationen des Cumidins und Xylidins. Wird dieses Nitrat in der üblichen Weise in die Base umgewandelt und dann der fractionirten Destillation unterworfen, so erstarrt der zwischen 225 bis 245° C. übergehende Anteil beim Abkühlen krystallinisch. Die Krystalle werden mittelst Centrifuge oder Pressen von noch anhaftenden nicht krystallisirbaren Basen befreit. Dieses krystallisirte Cumidin besitzt den Siedepunkt von 235 bis 236°, schmilzt bei 62° C. und lässt sich vorteilhaft zur Bildung von Azofarbstoffen verwenden. Es zeichnet sich namentlich dadurch aus, dass seine Diazoverbindungen mit dem sogenannten Rotsalze der Naphtoldisulfosäure ausgezeichnet feurig rote Farbstoffe liefert. Einen orangeroten Farbstoff erhält man durch Paarung der Diazoverbindung des krystallisirten Cumidins mit den Monosulfosäuren des Beta-Naphtols. Mit Schwefelsäure lässt sich dieses Cumidin leicht nach der für das Anilin bereits bekannten Weise in Cumidinsulfosäure überführen, dessen Diazoverbindung gleichfalls mit Naphtol Farbstoffe liefert.

Ein Patent von Herm. Schmidt in Frankfurt a. M. (D. P. 20909 vom 22. März 1882) bezweckt die Darstellung von Benzaldehyd, dessen Homologen und Substitutionsproducten durch Einwirkung von in Wasser verteiltem Mangandioxyd auf ein Gemenge von wesentlich 2 Molecülen Benzylchlorid und 1 Molecül Benzalchlorid:

$$2\,C^6H^5\cdot CH^2Cl + C^6H^5\cdot CHCl^2 + 2\,MnO^2 = 3\,C^6H^5\cdot CHO + 2\,MnCl^2 + H^2O.$$

Durch Weiterchloriren des aus dem Toluol dargestellten Bezylchlorids bis annähernd zum specifischen Gewicht 1·175 erhält man das erforderliche Gemisch von wesentlich 2 Molecülen Benzylchlorid und 1 Molecül Benzalchlorid. Specielles Verfahren: Ein Gemisch von 2 Benzylchlorid und 1 Benzalchlorid wird mit der sechsfachen Menge Wasser versetzt, worauf 2 Mol. Mangandioxyd zugefügt werden. Man kocht am Rückflusskühler so lange, bis alles Chlorid in Aldehyd übergeführt ist. Der Aldehyd wird mit Wasser-

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dampf abdestillirt und in bekannter Weise gereinigt. Von substituirtem Benzyl-benzalchlorid ausgehend, können in derselben Weise substituirte Benzaldehyde gewonnen werden. Die Chloride können durch die Bromide ersetzt werden. Die Operation kann auch unter Druck ausgeführt werden. Bei Anwendung der Oxyde des Bleies und Eisens wird in derselben Weise Benzaldehyd erhalten. Statt Wasser kann beispielsweise Alkohol zugesetzt werden.

Die Badische Anilin- und Sodafabrik in Ludwigshafen a. Rh. stellt die Monosulfosäure des Betanaphtylamins bezw. des Betanaphtols dar, um dieselben mit Azokörpern zu combiniren. (D. P. 20760 vom 17. November 1881.) Beim Behandeln von Betanaphtylamin mit concentrirter oder rauchender Schwefelsäure in der Wärme entstehen zwei isomere Monosulfosäuren in wechselnden Mengen, welche sich durch verschiedene Löslichkeit in Wasser unterscheiden. Die in Wasser leicht lösliche Säure bildet sich in überwiegender Menge bei der Einwirkung von rauchender Schwefelsäure bei Wasserbadtemperatur. Durch die gemässigste Einwirkung einer Säure von 96 bis 97 Proc. an Schwefelsäuremonohydrat bei 100 bis 105° lässt sich Betanaphtylamin beinahe vollständig in die schwer lösliche Modification überführen. Die so erhaltene schwer lösliche Sulfosäure wird mit Wasser fein zerrieben, mit englischer Schwefelsäure versetzt und bei niederer Temperatur, unter stetem Umrühren, durch Zufügung einer Lösung von Natriumnitrit in der zehnfachen Gewichtsmenge Wasser in die Diazoverbindung übergeführt; die vollständige Umwandlung bedarf längerer Zeit, und ein Ueberschuss von salpetriger Säure ist dazu erforderlich. Die schwer in Wasser lösliche Diazoverbindung wird durch Filtration und Abpressen von der Mutterlauge befreit und der Pressrückstand mit kaltem Wasser zu einem dünnen Brei angerührt, welcher portionenweise in kochendes Wasser eingetragen wird, das mit Schwefelsäure angesäuert wurde. Unter reichlicher Stickstoffentwickelung geht die Umwandlung rasch vor sich; sie ist beendet, wenn eine herausgenommene Probe beim Uebersättigen mit Alkali keine Rotfärbung mehr zeigt. Die saure Lösung der Oxysulfosäure wird mit Kalkmilch neutralisirt; das Kalksalz wird in das Natriumsalz übergeführt. Aus der alkoholischen Lösung krystallisirt das Natriumsalz der Betanaphtolmonosulfosäure in grossen Krystallnadeln aus. Diese Krystalle enthalten Alkohol und verlieren denselben beim Trocknen bei 100° C. Das so erhaltene amorphe Pulver $C^{10}H^6 < \begin{matrix} ONa \\ SO^3Na \end{matrix}$ ist äusserst leicht löslich in Wasser, sehr schwer löslich in kaltem 95proc. Alkohol (100 Tle. desselben lösen bei 15° C. 1 Tl. des Salzes), leicht löslich in siedendem Alkohol. Beim Ansäuern desselben mit der berechneten Menge Salzsäure entsteht ein saures Salz $C^{10}H^6 < \begin{matrix} OH \\ SO^3Na, \end{matrix}$ das in kochendem Alkohol sehr schwer löslich ist. Die freie Säure lässt sich in wässeriger Lösung durch Behandeln des schwer löslichen Bleisalzes mit Schwefelwasserstoff erhalten. Dampft man diese Lösungen aber ein, so spaltet

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sich diese Monosulfosäure in Betanaphtol und Schwefelsäure. Beim Erwärmen mit concentrirter Schwefelsäure wird die Verbindung in die bekannten Disulfosäuren des Betanaphtols übergeführt. Mit Salpetersäure in wässeriger Lösung behandelt, entsteht eine Nitrosulfosäure des Betanaphtols. Eisenchlorid färbt die wässerige Lösung blauviolet. Beim Zusammenbringen einer alkalischen Lösung der Betanaphtolsulfosäure mit der Diazomonosulfosäure des Azobenzols entsteht ein prachtvoll ponceau färbender Azofarbstoff, der in orangegelben Flocken ausfällt.

Farbfabrik vorm. Brönner in Frankfurt a. M. Verfahren zur Umwandlung der von Schäffer beschriebenen β-Naphtolmonosulfosäure*) in zwei neue β-Naphtylaminsulfosäuren und Darstellung von Farbstoffen aus denselben. (D. P. 22547 v. 5. Juli 1882.) Die β-Naphtolmonosulfosäure liefert mit Ammoniak bei hoher Temperatur behandelt, zwei neue β-Naphtylaminmonosulfosäuren. 60 kg β-naphtolmonosulfosaures Ammoniak (neutrales oder saures Salz) werden mit 12 kg Kalkhydrat oder irgend einem Ammoniak entbindenden Agens (20 kg calcinirter Soda) und 60 kg Wasser während 24 Stunden auf 180° unter Druck erhitzt. Die Reactionsmasse wird dann in 50 l heissem Wasser gelöst und angesäuert. Die entstandene schwer lösliche β-Naphtylaminmonosulfosäure, das Hauptproduct der Einwirkung, scheidet sich in krystallinischen Massen ab. Auch das Natriumsalz, mit kohlensaurem Natron und Salmiak erhitzt, giebt gute Resultate. Diese Naphtylaminmonosulfosäure unterscheidet sich in ihren Eigenschaften wesentlich von der vorhin beschriebenen aus β-Naphtylamin dargestellten schwer löslichen Sulfosäure (s. oben D. P. 20760); sie löst sich in etwa 260 Teilen siedenden Wassers, die aus β-Naphtylamin dargestellte dagegen in etwa 70 Teilen. Während die aus Naphtylamin dargestellte Säure leicht lösliche, schwer krystallisirende Salze bildet, besitzen die schwer löslichen Salze dieser Säure hohe Krystallisationsfähigkeit. So löst sich z. B. das Bariumsalz der aus Naphtolsulfosäure dargestellten Amidosäure in etwa 180 Teilen Wasser von 15° C., während sich das Bariumsalz der aus Naphtylamin dargestellten Säure in etwa 9·5 Teilen Wasser von 15° C. löst. Sowol die freie Säure als auch ihre Salze zeichnen sich durch prachtvollen Silberglanz aus, der den Verbindungen der Säure aus β-Naphtylamin fehlt. Die Mutterlauge enthält eine zweite in Wasser leicht lösliche β-Naphtylaminmonosulfosäure; zur Gewinnung derselben wird die Mutterlauge mit Soda neutralisirt, zur Trockne verdampft und mit 2 bis 3 Teilen Alkohol von 90° ausgekocht. Aus der angesäuerten alkoholischen Lösung scheidet sich die Säure beim Erkalten aus. Die so erhaltene β-Naphtylaminmonosulfosäure ist nicht identisch mit der leicht löslichen Sulfosäure aus β-Naphtylamin. Diese Säure löst sich in 190 Teilen 90procentigen siedenden Alkohol, die andere in 100 Teilen Alkohol. Durch Combination der Diazoverbindungen der beiden β-Naphtylaminmonosulfosäuren mit den Phenolen, Oxyphenolen und Naphtolen, deren Aether und Sulfosäuren entsteht eine Reihe Farbstoffe,

*) Lieb. Ann. Chem. 152, S. 296.

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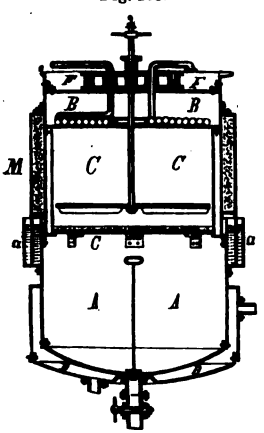
deren Nüancen je nach dem zur Anwendung gekommenen Componenten zwischen gelb bis rotviolet bezw. braunrot schwankt. Die schwer lösliche Säure liefert die mehr gelben, die leicht lösliche Säure dagegen die mehr roten bezw. blauen Nüancen. So giebt z. B. die Diazoverbindung der schwerlöslichen Sulfosäure mit Phenol ein sehr gelbes Orange, mit β-Naphtolmonosulfosäure Gelbrot, mit α-Naphtolmonosulfosäure Blutrot, mit α-Naphtol desgleichen. Die Diazoverbindungen der leicht löslichen Sulfosäuren geben dagegen mit β-Naphtolmonosulfosäure Ziegelrot, mit α-Naphtolmonosulfosäure und α-Naphtol tief Blaurot.

Ein von Meister, Lucius & Brüning in Höchst a. M. patentirtes Verfahren zur Darstellung von Zimmtsäure und von substituirten Zimmtsäuren (D. P. 21162 vom 2. Juli 1882) aus Benzylidenaceton bezw. aus den entsprechenden Substitutionsproducten desselben besteht darin, dass diese Ketone der Einwirkung von unterchlorig-, unterbromig- oder unterjodigsauren Salzen ausgesetzt werden. Die Bildung von Zimmtsäure, z. B. aus Benzylidenaceton, findet statt nach der Gleichung: $C^6H^5 \cdot CH \cdot CH \cdot CO \cdot CH^3 + 3\,NaOCl = C^6H^5 \cdot CH \cdot CH \cdot CO\,O\,Na + CHCl^3 + 2\,NaOH$. — Specielles Verfahren: 15 Teile Benzylidenaceton werden mit einer Lösung von 48 Teilen Brom in 650 Teilen 4procentiger Natronlauge auf dem Wasserbade gelinde erwärmt. Sobald sich in der Flüssigkeit keine unterbromige Säure mehr nachweisen lässt, hat sich die durch obige Gleichung ausgedrückte Umwandlung des Ketons in Zimmtsäure vollzogen. Nach der Trennung des gebildeten Bromoforms von der wässerigen Flüssigkeit versetzt man dieselbe mit verdünnter Schwefelsäure, sammelt die ausgeschiedene Zimmtsäure und reinigt sie durch Umkrystallisiren aus Wasser oder Alkohol. In derselben Weise verfährt man, wenn an Stelle des Benzylidenacetons seine im Benzolkern substituirten Derivate zur Darstellung substituirter Zimmtsäure Verwendung finden sollen. Erwärmt man z. B. 20 Teile Orthonitrobenzylidenaceton, darstellbar nach dem Patent 20255, mit 800 Teilen einer 3procentigen wässerigen Lösung von unterchlorigsaurem Natron, so erhält man, nach oben beschriebener Methode arbeitend, fast die theoretische Menge von Orthonitrozimmtsäure.

Fig. 285.



Julius Brönner in Frankfurt a. M. hat einen Apparat zum Reinigen von Anthrachinon, Alizarin und andern Stoffen construirt. (D. P. 21681 vom 31. Marz 1882.) Das mit 1 bis 2 Proc. calcinirter Soda gemischte Rohantrachinon kommt auf das Filter *C* in einen Extractionsapparat. Am oberen Teil des Kessels *A* ist eine Rinne *a*, die, mit Flössigkeit gefüllt, einen hydraulischen Abschluss für den Deckel bildet. An der Decke der Haube *B* befindet sich eine Kühlrohrschlange. Das Kühlwasser fliesst aus dem

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Rohr zunächst in ein Bassin *F* und dann fort. Die Seitenwände der Haube sind von dem mit einem schlechten Wärmeleiter gefüllten Mantel *M* umgeben. *D* ist ein Mantel für Dampfheizung. In den Kessel *A* kommt nur gerade so viel Lösungsmittel, dass in der Hitze alle auf dem Filter befindlichen löslichen Stoffe gelöst werden, dass das schwer lösliche Anthrachinon aber beim Erkalten auskrystallisirt.

2. Anilin-Farbstoffe.

Philipp Greiff in Frankfurt a. M. Herstellung von Farbstoffen der Rosanilin-Gruppe durch Einwirkung von Nitrobenzylchlorid auf Salze primärer Amine bei Gegenwart von Oxydationsmitteln. (D. P. 19304 vom 3. Februar 1882, Zus. zu D. P. 15120*). Das Princip der Erfindung ist, die Methylgruppe, welche die einzelnen Molecule zu dem Rosanilinmolecul vereinigt, durch Einführung von Chlor oder dergl. reactionsfähiger zu machen. Es wird dadurch die Bildung einer grossen Menge schädlicher Substanzen, die bei dem gewöhnlichen Coupier'schen Verfahren auftreten, vermieden. Ausser Nitrobenzylchlorid oder -bromid können nun auch Nitrotoluole (und Homologe), welche in der Methylgruppe mehrere Atome Chlor oder Brom, oder Hydroxyl oder Säurereste enthalten, verwendet werden. Wie bei der gewöhnlichen Fuchsinschmelze sind Sauerstoffüberträger, wie Eisen, dessen Oxyde oder Salze, notwendig.

Nach O. Fischer (Ber. chem. Ges. 1882, S. 676) wird Diamidotriphenylmethan durch Digeriren von 10 Tln. Benzaldehyd, 28 Tln. schwefelsaurem Anilin und 20 Tln. Chlorzink auf dem Wasserbade, bis der Aldehydgeruch nur schwach ist, hergestellt. Man verdünnt die mit Schwefelsäure angesäuerte Lösung mit Wasser, scheidet etwas Harz ab und fällt die Basis. Aus dem Harz kann man durch Kochen mit Säure noch etwas Basis gewinnen. Die Ausbeute beträgt 80 Proc. der theoretischen Menge. Bei Anwendung von 1 Mol. Paranitrobenzaldehyd auf 1 Mol. schwefels. Anilin erhält man Paranitrodiamidotriphenylmethan, welches bei der Reduction Paraleukanilin giebt. Bei Ersatz des Anilins durch Orthotoluidin erhält man Diortholeukotoluidin. Das hieraus entstehende Fuchsin hat einen mehr bläulichen Ton als Parafuchsin. Ueberhaupt geht durch den Eintritt von Methyl in die Benzolgruppe des Pararosanilins die Farbnuance nach Blau, aber nicht in dem Maasse, wie wenn das Methyl in die Amidogruppe eintritt. Orthotoluidin condensirt sich mit Paranitrobenzaldehyd leichter als Anilin — vielleicht der Grund, weshalb beim technischen Fuchsinprocess, wo ein Gemenge von Paratoluidin, Orthotoluidin und Anilin benutzt wird, sich so wenig Pararosanilin bildet.

Die Farbwerke, vormals Meister, Lucius & Brüning in Höchst a. M. geben ein Verfahren an (D. P. 19484 vom 3. Januar 1882), nach welchem die Salze des Paraleukanilins $[CH(C^6H^4NH^2)^3]$ und seiner Homo-

*) Techn.-chem. Jahrb. 1882, S. 357.

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logen durch Erhitzen mit den Hydraten gewisser Metalloxyde, die, wie Eisenoxyd, Manganoxyd, Kupferoxyd, eine oxydirende Wirkung ausüben, in Farbstoffe der Rosanilinreihe übergeführt werden. — Eine innige Mischung von 1 Teil salzsaurem Leukanilin mit einem Ueberschuss von Eisenoxydhydrat wird so lange auf 120 bis 160° in offenen oder geschlossenen Gefässen erhitzt, bis eine metallisch glänzende grüne Schmelze entstanden ist. Durch Auskochen der Masse mit Wasser, Filtriren der erhaltenen Lösung und Versetzen des Filtrats mit Kochsalz erhält man den gebildeten Farbstoff, der, wenn erforderlich, nach bekannten Methoden gereinigt werden kann.

Meldola beschreibt in Chem. News 47, 133 Farbstoffe, welche zur Rosanilingruppe gehören und entstehen, wenn eine Rosanilinbase mit β-Naphtylamin einige Minuten lang auf eine über dem Schmelzpunkt des letztern liegende Temperatur erhitzt wurde, indem gleichzeitig etwas Benzoesäure oder Essigsäure zugesetzt wird. Es entwickelt sich Ammoniak und es entsteht eine blaue Schmelze, die als Farbstoff wahrscheinlich Trinaphtylamin enthält. Derselbe hat eine etwas rötlichere Nuance als Triphenylblau.

Eine Mischung von 1 Mol. Paratoluidin und 2 Mol. Diphenylamin mit der erforderlichen Menge Arsensäure erhitzt, lieferte einen purpurnen Farbstoff, vermutlich Diphenylrosanilin.

Kalle & Co. in Biebrich a. R. Darstellung von Rosanilinsulfosäuren. (D. P. 19715 vom 8. September 1881.) Die unbeständigen sauren schwefelsauren Salze des Rosanilins werden in höherer Temperatur nicht, wie das Rosanilin durch einen Ueberschuss von Schwefelsäure, zersetzt. Ein Salz, aus 2 Mol. Schwefelsäure und 1 Mol. Rosanilin bestehend, geht bei einer Temperatur von 180 bis 200° in die Disulfosäure über, ohne dass mehr als Spuren von schwefliger Säure entweichen. Man stellt das Calcium- und aus diesem das Natriumsalz der Rosanilindisulfosäure dar.

Folgendes Verfahren wird angegeben. 30 kg Rosanilin (event. auch Pararosanilin) werden mit 20 kg Schwefelsäure von 60° B., welche zuvor mit 100 bis 200 l Wasser verdünnt wurden, angerührt. Man fügt, um die Masse locker zu machen, 400 kg reinen Sand hinzu und dampft unter Rühren zur Trockne. Der Rückstand wird bei 130 bis 140° getrocknet und gepulvert. In einem passenden, mit Rührer versehenen Gefäss setzt man das Gemisch 5 bis 6 Stunden lang einer Temperatur von 180 bis 200° C. aus. Es ist vorteilhaft, dabei einen indifferenten Gasstrom, trockene Kohlensäure, durch das Gefäss passiren zu lassen. Bei richtig geleiteter Operation dürfen höchstens Spuren von schwefliger Säure entweichen. Die so behandelte Masse wird bis zur Erschöpfung mit Wasser ausgekocht und der Auszug mit Kalkmilch übersättigt. Dabei scheidet sich, mit Calciumsulfat gemischt, etwas unverändertes Rosanilin aus, welches zu neuen Operationen verwendet werden kann. Das in Lösung befindliche Kalksalz der Rosanilinsulfosäure wird auf bekannte Weise in das Natronsalz verwandelt.

K. Oehler in Offenbach stellt die Rosanilinsulfosäuren durch Einwirkung von Aethionsäureanhydrid und Aethionsäurechlor-

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hydrin auf Rosanilinfarbstoffe her. (D. P. 19847 vom 16. August 1881; Engl. P. 5586 vom 21. December 1881.) Das Aethionsäureanhydrid (Carbylsulfat) wird durch directe Vereinigung von Aethylen mit Schwefelsäureanhydrid gewonnen, das noch nicht beschriebene Chlorhydrin der Aethionsäure durch Einwirkung von Chloräthyl auf Schwefelsäureanhydrid. Dasselbe entsteht wenn die Reaction durch Abkühlen nicht gemässigt wird; es bildet feine weisse Nadeln von der Zusammensetzung $C^2H^4 < \frac{SO^2Cl}{SO^3H}$ Von diesen Körpern werden 3 bis 4 Tle. mit 1 Tl. Farbbase gemischt. Die Mischung wird auf 100° erwärmt, bis sich eine Probe völlig in verdünntem Alkali löst. Auch das von T. v. Purgold auf andere Weise (Ber. chem. Ges. 1883, S. 502) erhaltene Einwirkungsproduct von Chloräthyl auf Schwefelsäureanhydrid soll bei dieser Reaction benutzt werden.

Kalle & Co. in Biebrich a. R. stellen ferner die Sulfosäuren von Rosanilinen, Anthrachinon, Alizarin, Amidoazobenzol etc. unter Anwendung von Schwefelsäurehydrat und Metaphosphorsäure her. (D. P. 19721 vom 30. November 1881.) Ein Gemisch von 1 Tl. glasiger Metaphosphorsäure und 2 Tln. Schwefelsäurehydrat wirkt so stark sulfurirend wie rauchende Schwefelsäure von 25 bis 30 Proc. Anhydridgehalt, aber gleichmässiger als dieses. Es findet bei diesem Verfahren keine Bildung von Schwefelsäureanhydrid statt. Denn einmal raucht das Gemisch nicht an der Luft, mischt sich mit Wasser, ohne zu zischen, und wirkt auf Papier, Holz und andere organische Stoffe nicht verkohlend. Ferner, während sich von rauchender Schwefelsäure das Anhydrid bei 150° C. fast vollständig abdestilliren lässt, entweichen aus dem Gemische selbst bei 280 bis 300° nur Spuren von schon mit überdestillirendem Hydrat gemischten Anhydriddämpfen. Das Verfahren bietet bedeutende technische und ökonomische Vorteile, denn einmal umgeht es das lästige Arbeiten mit stark rauchender Schwefelsäure, und ist eine Verkohlung der Substanz dabei weniger zu befürchten, andererseits lässt sich die Phosphorsäure dabei fast quantitativ wiedergewinnen und aufs neue in Metaphosphorsäure umwandeln. Es wird für die eigentliche Sulfurirung somit nur das Schwefelsäurehydrat verbraucht.

Die Sulfurirungsschmelze wird in Wasser gegossen und auf bekannte Weise in das Kalksalz, sodann in das Natronsalz der Sulfosäuren verwandelt. Man erhält daneben alle Phosphorsäure als Calciumphosphat mit Calciumsulfat gemengt. Durch Behandeln dieses Rückstandes mit der berechneten Schwefelsäuremenge lässt sich die Phosphorsäure in Lösung bringen und durch Abdampfen und Glühen in Metaphosphorsäure überführen.

Otto N. Witt in Mülhausen dehnt die Farbstoffbildung durch Einwirkung von Nitrosokörpern oder Chlorchinonimiden auf Metadiamine*) auch auf aromatische Monamine aus. (D. P. 19224 vom 18. Februar 1882. Bei der Einwirkung von Nitrosokörpern (Nitrosodimethylanilin, auch

*) Techn.-chem. Jahrb. 1883, S. 334.

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Nitrosophenole) oder Chlorchinonimiden auf primäre Monamine bilden sich nur geringe Mengen von Farbstoff.*) Farbstoffe von grosser Intensität treten dagegen als Hauptproducte auf bei Anwendung secundärer und tertiärer Amine. Die Farbstoffe sind wasserlöslich und krystallisirbar. Die Einwirkung erfolgt zwischen gleichen Moleculen in essigsaurer Lösung. Nach Beendigung der bei der Wasserbadtemperatur vorgehenden Reaction wird der als Acetat in Lösung befindliche Farbstoff durch Zusatz von Salzsäure in das Chlorhydrat verwandelt, durch siedendes Wasser in Lösung erhalten und schliesslich durch Zusatz von mehr Salzsäure oder Kochsalz in krystallinischer Form gefällt. Dimethylanilin, Aethylanilin, Aethylmethylanilin und ähnliche Basen geben violette, Diphenylamin, Methyldiphenylamin und dergleichen blaue und grüne, die Naphtylamine und deren methylirte etc. Abkömmlinge rote und violette, die Naphtylphenylamine violette Farbstoffe.

Farbwerke, vormals Meister, Lucius und Brüning in Höchst a. M. Herstellung von Farbstoffen durch Erhitzen von acetylirten Basen mit wasserentziehenden Mitteln. (D.P. 19766 vom 10. December 1881.) Die Acetylverbindungen der primären und secundären aromatischen Basen für sich oder mit einem Salz einer aromatischen Base gemischt, liefern, mit einem wasserentziehenden Mittel bei geeigneter Temperatur erhitzt, basische Farbstoffe. Ein gelber Farbstoff, den der Entdecker O. Fischer Flavanilin nennt, entsteht z. B., wenn Acetanilid und Chlorzink zu gleichen Teilen oder ein Teil Acetanilid, zwei Teile salzsaures Anilin und zwei Teile Chlorzink auf 230 bis 250° erhitzt werden. An Stelle des Acetanilids kann man Essigsäure und Anilin oder überhaupt Mischungen, welche Acetanilid erzeugen können, verwenden. Das Reactionsproduct wird mit Wasser ausgekocht, um das Chlorzink zu entfernen. Dann wird der Rückstand mit verdünnten Säuren behandelt und aus der Lösung wird der Farbstoff ausgesalzen. Durch Einwirkung der Alkyljodüre etc. lassen sich die Farbstoffe methyliren etc. Auch liefern dieselben Sulfosäuren. Die Patentansprüche beziehen sich auf die Anwendung von acetylirtem Anilin, Toluidin und Xylidin, sowie der monomethylirten Basen, auf die Darstellung der Methyl-, Aethyl- etc. Derivate der Farbstoffe, sowie der Sulfosäuren derselben.

Ebenso wie aus Acetanilid durch Erhitzen mit Chlorzink Flavanilin entsteht, liefern nach dem Zusatz-Patent 21682 vom 6. April 1882 von Meister, Lucius und Brüning auch die acetylirten Amidobenzoesäuren bei gleicher Behandlung denselben Farbstoff. (Amidobenzoesäure zerfällt bekanntlich leicht in Anilin und Kohlensäure.) An Stelle der Monoacetylamidobenzoesäure kann man Mischungen verwenden, die zur Bildung dieser Säure geeignet sind, z. B. Eisessig und Amidobenzoesäure oder essigsaures Zink und salzsaure Amidobenzoesäure. Ueberhaupt können die Basen durch ihre Carboxylsubstitutionsproducte ersetzt werden.

*) In Bezug auf Anilin ist ein violetter Farbstoff bereits von Kimich beobachtet worden; vgl. Ber d. chem. Ges. 8, 1032.

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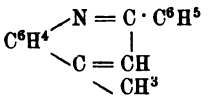
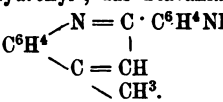
Ueber das Flavanilin machen O. Fischer und E. Besthorn einige nähere Mitteilungen in Ber. chem. Ges. 16, 68 (auch Chem. Ind. 1883, 102). Das Flavanilin wird von den Verfassern als das Amidoderivat einer als Flavolin bezeichneten Base $C^{16}H^{13}N$ betrachtet, welche aus jenem durch Behandlung mit salpetriger Säure und Erhitzen des hierbei gebildeten Flavenols $OHC^{16}H^{12}N$ mit Zinkstaub erhalten wurde. In der That gelingt es, das Flavolin wieder in Flavanilin zu verwandeln. Wird Flavolin in der 10fachen Menge rauchender Salpetersäure gelöst und die Lösung bei 50—60° digerirt, so entsteht neben anderen Nitrokörpern ein Mononitroflavolin, welches durch Reduction mittelst Zink und Eisessig in Flavanilin übergeht. Das aus Flavanilin mittelst salpetriger Säure entstehende Flavenol $C^{16}H^{13}NO$ bildet krystallisirende, intensiv gelbe Salze, und liefert beim Kochen mit Essigsäureanhydrid ein bei 128° schmelzendes Acetylflavenol. Trägt man in eine stark verdünnte alkalische Lösung von Flavenol (5 Tle.) allmälig eine kalt gesättigte Lösung von Kaliumpermanganat (30 Teilen) ein und erwärmt, so entsteht eine bei 182° schmelzende Säure $C^{11}H^{9}NO^{2}$, welche mit Kalk erhitzt ein Lepidin liefert, demnach allem Anschein nach eine Lepidincarbonsäure ist. Oxydirt man dagegen Flavenol mit der neunfachen Menge Kaliumpermanganat, so entsteht eine Picolintricarbonsäure $C^{9}H^{7}NO^{6}$; dieselbe, durch das Bleisalz gereinigt, bildet glänzende Nadeln, welche bei 230—232° unter Entwickelung von Kohlensäure schmelzen. Verfasser betrachten das Flavolin als ein Phenyllepidin



das Flavenol als dessen Hydroxyl-, das Flavanilin als dessen Amidoderivat:



Bei der Bildung des Flavanilins aus Acetanilid entsteht als Zwischenproduct Orthoamidoacetophenon $C^{6}H^{4}\begin{matrix}NH^{2}\\CO\cdot CH^{3}\end{matrix}$, von welchem wahrscheinlich zwei Molecule unter Abspaltung von zwei Moleculen Wasser sich zu Flavanilin condensiren. Es wurde aus Orthoamidoacetophenon durch Erhitzen mit Chlorzink auf 230° Flavanilin erhalten.

E. Nölting und E. von Salis-Mayenfeld in Mülhausen. Darstellung gelber, oranger und brauner Farbstoffe. (D. P. 22268 vom 31. August 1882.)

Die Farbstoffe bestehen aus den Sulfosäuren nitrirter secundärer und tertiärer aromatischer Amine oder tertiärer Amine, die zwei aromatische und ein fettes Radical enthalten. Halogennitrokörper, deren Nitrogruppen zu einander in der Metastellung, zum Halogen in der Ortho- oder Parastellung stehen, wirken leicht so auf Amine ein, dass unter Salzsäureabspaltung ein secundäres oder tertiäres Nitramin gebildet wird, z. B. Dinitrodiphenylamin

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aus Dinitrochlorbenzol und Anilin. Diese Nitramine sind schwerlösliche Farbstoffe, werden aber durch Sulfonirung löslich und färben dann Wolle oder Seide ohne Beize gelb bis braun. Die Sulfosäuren enstehen aber auch, wenn die Halogennitroverbindungen auf die Sulfo- oder Carboxylderivate der Amine einwirken.

Die Erfinder lassen folgende Körper: Chlordinitrobenzol, Chlortrinitrobenzol, Orthochlordinitrotoluol, Parachlordinitrotoluol, Chlordinitronaphtalin, Chlortrinitronaphtalin, Chlortetranitronaphtalin einwirken auf: Anilin, Ortho- und Paratoluidin, die Xylidine, Methylanilin und Homologe, Diphenylamin, Phenyltolyl- und Ditolylamine, die Dinaphtylamine, Amidoazobenzol, dessen Homologe und Substitutionsproducte, Amidoazonaphtalin, Benzidin, Diamidotriphenylmethan, Leukanilin; ferner auf: Sulfanilsäure, Metaamidobenzolsulfosäure, Toluidin- etc. sulfosäuren, β-Naphtylaminsulfosäuren und die Sulfosäuren der übrigen genannten Amine und Azokörper. Von besonderem Interesse sind die orangen Farbstoffe, die durch Einwirkung von Pikrylchlorid oder Chlorbinitrobenzol auf Aechtgelb (Amidoazobenzolsulfosäure) oder Diphenylaminorange (Phenylamidoazobenzolsulfosäure) entstehen.

Ueber die Farbstoffe der Safraninreihe hat R. Nietzki Mitteilungen gemacht. Durch Oxydation von 2 Mol. Anilin und 1 Mol. Paraphenylendiamin oder von gleichen Mol. Anilin und Paradiamidodiphenylamin $(NH^2C^6H^4)^2NH$ entsteht ein zuerst von Witt dargestellter, der Safraninreihe angehöriger Farbstoff, das „Phenosafranin". Das Chlorhydrat des Phenosafranins bildet cantharidengrüne, flache Nadeln, schwer in kaltem, leicht in heissem Wasser löslich, und besitzt die Zusammensetzung $C^{18}H^{16}N^4HCl$. In Salzsäure ist es unlöslich. Das Platinsalz stellt goldglänzende Blättchen dar. Das Phenosafranin zeigt das charakteristische Verfahren aller Safraninfarbstoffe gegen concentrirte Säuren, starke Schwefelsäure färbt es grün, etwas verdünntere Schwefelsäure oder concentrirte Salzsäure dagegen blau. Erhitzt man das mit trocknem Natriumnitrat gemischte Chlorhydrat mit Essigsäureanhydrid, so entsteht das unlösliche Chlorhydrat des Diacetylphenosafranins $C^{18}H^{14}N^4(C^2H^3O)^2,HCl$. Dasselbe löst sich in alkoholischer Natronlauge mit violetroter Farbe und wird aus dieser Lösung durch Salzsäure wieder abgeschieden.

Versetzt man eine mit Salzsäure angesäuerte, wässerige Lösung von Phenosafranin mit verdünnter Natriumnitritlösung, so geht die rote Farbe in Blau über, Platinchlorid fällt ein blaues, aus langen Nadeln bestehendes Platinsalz eines Diazokörpers, welcher die Zusammensetzung $C^{18}H^{15}N^5Cl^2$ hat. Es ist demnach nur eine Amidogruppe im Phenosafranin diazotirt worden: $C^{18}H^{14}<\begin{matrix}N^3HCl\\N=NCl\end{matrix}$.

Durch Oxydation von Diäthylparaphenylendiamin $C^6H^4<\begin{matrix}N(C^2H^5)^2\\NH^2\end{matrix}$ mit 2 Mol. Anilin entsteht ein fuchsinroter Farbstoff, dessen Chlorhydrat in grünschillernden Nadeln krystallisirt und die Zusammensetzung

$$C^{18}H^{14}N^4(C^2H^5)^2HCl$$

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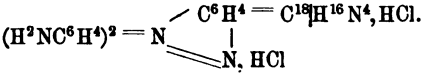
besitzt, demnach ein Diäthylsafranin darstellt. Dasselbe nimmt bei Behandlung mit Essigsäureanhydrid nur eine Acetylgruppe auf.

Ein isomeres (β-) Diäthylsafranin von ähnlichen Eigenschaften wird durch Oxydation eines Gemisches von 1 Mol. Paraphenylendiamin, 1 Mol. Diäthylanilin und 1 Mol. Anilin erhalten. Beide Diäthylsafranine werden mittelst Natriumnitrits in schwarzblaue Diazoverbindungen $C^{18}H^{13}N^5(C^2H^5)^2Cl^2$ verwandelt.

Oxydirt man ein Gemenge von gleichen Molecülen Diäthylparaphenylendiamin, Diäthylanilin und Anilin, so entsteht ein Farbstoff von mehr violeter Nuance, das Tetraäthylsafranin, $C^{18}H^{12}(C^2H^5)^4N^4, HCl$. Das Chlorhydrat ist sehr leicht löslich, dagegen bildet das Chlorzinkdoppelsalz schwer lösliche, goldglänzende Blättchen. Der Farbstoff ist wenig lichtecht. Auch das Tetraäthylsafranin zeigt gegen concentrirte Säure das charakteristische Verhalten aller Safranine, es wird indess von salpetriger Säure und Essigsäureanhydrid nicht angegriffen. Alle Safranine haben ferner die Eigenschaft gemeinsam, durch Reduction in leicht oxydable Leukokörper überzugehen.

Als Zwischenproducte der Safraninbildung müssen die blauen und grünen Körper aufgefasst werden, welche bei der Oxydation des Basengemisches in der Kälte entstehen. Von diesen Producten zeigt der von Bindschedler durch Oxydation eines Gemenges von Dimethylparaphenylendiamin mit Dimethylanilin dargestellte grüne Körper eine grössere Beständigkeit. Derselbe bildet ein in Wasser mit grüner Farbe leicht lösliches, schön krystallisirendes Zinkdoppelsalz, aus welchem man mittelst Jodkalium ein in grünen Nadeln krystallisirendes Jodür $C^{16}H^{20}N^3J$ darstellen kann. Durch Reduction mit Zinnchlorür geht der grüne Körper in eine Leukobase über, welche ein krystallisirendes Zinkdoppelsalz $C^{16}H^{23}N^3Cl^2 + ZnCl^2$ bildet. Verfasser hält diese Leukobase für ein Tetramethyldiamidodiphenylamin $[(CH^3)^2NC^6H^4]^2 = NH$. Es wird aus den Untersuchungen gefolgert, das einfachste Safranin sei ein Derivat des Triphenylamins von der Formel



(Ber. chem. Ges. 16, 464; Chem. Ind. 1883, 167.)

R. Bindschedler beschreibt den eben erwähnten grünen Körper. Behandelt man 1 Mol. Dimethylparaphenylendiamin und 1 Mol. Dimethylanilin in wässriger, chlorzinkhaltiger Lösung bei 30° mit Kaliumbichromat, so scheiden sich prachtvolle, kupferglänzende Krystalle von Dimethylphenylengrün $(C^{16}H^{19}N^3, HCl)^2 + ZnCl^2$ ab. Wendet man statt Zinkchlorid Quecksilberchlorid an, so entsteht das entsprechende Quecksilbersalz.

Die Bildung des in Wasser mit grüner Farbe löslichen, und beständigen Farbstoffs erfolgt nach der Gleichung:

$$NH^2C^6H^4N(CH^3)^2 + C^6H^5N(CH^3)^2 + O^2 = C^{16}H^{19}N^3 + 2H^2O.$$

Reductionsmittel verwandeln den Farbstoff in die Leukobase $C^{16}H^{21}N^3$,

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welche gelbe, tafelförmige Krystalle vom Schmelzpunkt 119° (uncorr.) bildet. (Tetramethyldiamidodiphenylamin.)

Vermischt man das Dimethylphenylengrün mit 1 Mol. essigsaurem Anilin und oxydirt bei Siedehitze mit Kaliumbichromat, so entsteht ein violetter Farbstoff, das Tetramethylphenylensafranin. Das salpetersaure Salz $C^{22}H^{23}N^{41}$, $HNO^3 + H^2O$ bildet bräunlich violette, centimeterlange Krystalle; das salzsaure Salz ist sehr leicht löslich. Der Farbstoff entsteht aus Dimethylphenylengrün nach der Gleichung:

$$C^{16}H^{19}N^3 + C^6H^5NH^2 + O^2 = C^{22}H^{22}N^4 + 2H^2O,$$

oder, vom Diamethylparaphenylendiamin ausgehend, nach der Gleichung:

$$NH^2C^6H^4N(CH^3)^2 + C^6H^5N(CH^3)^2 + C^6H^5NH^2 + O^4 = C^{22}H^{22}N^4 + 4H^2O.$$

Diese Resultate stehen im Einklang mit der Untersuchung von A. W. Hofmann und Geyger über das gewöhnliche Safranin, welches aus 1 Mol. Toluylendiamin und 2 Mol. Toluidin sich bildet nach der Gleichung:

$$CH^3C^6H^3(NH^2)^2 + 2CH^3C^6H^4NH^2 + O^4 = C^{21}H^{20}N^4 + 2H^2O.$$

Die Resultate des Verfassers differiren dagegen von den Angaben von Nietzki (s. oben), nach welchen die entsprechenden Safranine 2 Atome Wasserstoff mehr enthalten.

Durch Oxydation von 1 Mol. Dimethylparaphenylendiamin und 2 Mol. Anilin mit Kaliumbichromat entsteht ein fuchsinroter Farbstoff, das Dimethylphenylensafranin $C^{20}H^{18}N^4$, dessen Chlorhydrat in Wasser und Alkohol ziemlich schwer löslich ist.

Der Bildungsprocess dieses Farbstoffes wird durch die Gleichung ausgedrückt:

$$NH^2C^6H^4N(CH^3)^2 + 2C^6H^5NH^2 + O^4 = C^{20}H^{18}N^4 = 4H^2O.$$

Auch durch Oxydation eines Gemisches von Phenylendiamin und reinem Anilin lässt sich ein Safraninfarbstoff und zwar der einfachste Repräsentant aller Safranine, das Phenylensafranin $C^{18}H^{14}N^4$ gewinnen. Zur Darstellung desselben wurden 3 kg reines Anilin mit salpetriger Säure behandelt, dann mit Zink und Salzsäure reducirt und mit Kaliumbichromat oxydirt, nach der Neutralisation mit Kalkmilch der Farbstoff (410 g) durch Kochsalz abgeschieden. Die Bildung des Farbstoffs giebt die Gleichung wieder:

$$C^6H^4(NH^2)^2 + 2C^6H^5NH^2 + O^4 = C^{18}H^{14}N^4 + 4H^2O.$$

Das salpetersaure Phenylensafranin $C^{18}H^{14}N^4, HNO^3$ ist ein grüner metallisch glänzender Körper, aus mikroskopischen, orthorhombischen Blättchen bestehend. Bei der Reduction der Safranine zu Leukobasen werden vier Atome Wasserstoff aufgenommen. (Ber. chem. Ges. 16, 864; Chem. Ind. 1883, S. 168.)

Die violetten Derivate des Triphenylmethans haben O. Fischer und L. German untersucht. Die durch Reduction des Methylvioletts entstehende Leukobase (Schmelzpunkt 173°) wird weder durch Benzoylchlorid oder Acetylchlorid, noch durch Jodmethyl und Natrium afficirt, enthält demnach jedenfalls nicht, wie seither angenommen, fünf, sondern sechs Methylgruppen, sie ist ein Hexamethylparaleukanilin $CH[C^6H^4N(CH^3)^2]^3$. Das von Wichelhaus

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untersuchte, aus Dimethylanilin mittelst Chloranils entstehende Violet ist mit der erwähnten Leukobase offenbar identisch und besitzt nicht die ihm von Wichelhaus gegebene Formel.*) Die von O. Fischer aus Chloral und Dimethylanilin dargestellte und als „Hexamethylparaleukanilin" bezeichnete Base (Schmelzpunkt 250°) hat mit der erwähnten Base nichts gemein und besitzt jedenfalls eine andere Zusammensetzung. Dagegen entsteht die Leukobase des Methylvioletts aus dem Tetramethylleukanilin $CH\begin{matrix}/C^6H^4NH^2\\ \backslash[C^6H^4N(CH^3)^2]^2\end{matrix}$, welches aus Paranitrobenzaldehyd und Dimethylanilin gewonnen wird, durch Methylirung mittelst Jodmethyls. Dasselbe Tetramethylleukanilin liefert beim Erhitzen mit Essigsäureanhydrid eine in Nadeln vom Schmelzpunkt 108° krystallisirende Acetylverbindung, welche bei der Oxydation mit Braunstein und verdünnter Schwefelsäure nicht einen violetten, sondern einen grünen Farbstoff ergiebt. (Ber. chem. Ges. 16, 706; Chem. Ind. 1883, 168.)

Das von Meldola aus Diphenylamin und Benzotrichlorid und durch nachfolgende Oxydation dargestellte Viridin**) ist das salzsaure Salz der Base $C^6H^5 \cdot HO \cdot C = (C^6H^4 \cdot NHC^6H^5)^2$, des Diphenyldiamidotriphenylcarbinol. (Chem. News 45, S. 127.)

Bei Erhitzen von Anilin, oder der Homologen, mit 1 oder 2 Mol. Epichlorhydrin entstehen nach J. v. Hörmann schwache Basen, die mit Chloranil oxydirt, blauviolete bis blaue Farbstoffe ergeben. Dieselben zersetzen sich aber beim Kochen mit Wasser (Ber. chem. Ges. 1882, S. 1542).

Horace Koechlin in Lörrach stellt Farbstoffe her durch Einwirkung von salzsaurem Nitrosodimethylanilin auf Tannin, Gerbsäure oder Gallussäure. (D. P. 19580 vom 17. December 1881.) 2 Gewtle. Tannin und 1 Gewtl. salzsaures Nitrosodimethylanilin werden in 10 Tln. Wasser gelöst und so lange erwärmt, bis die Farbintensität nicht mehr zunimmt. Dann wird die Masse in viel Wasser gegossen, und der Farbstoff durch Kochsalz ausgefällt. Als Lösungsmittel kann auch Alkohol oder Essigsäure dienen. In letzterem Falle wird vor dem Aussalzen neutralisirt. In gleicher Weise können Chinagerbsäure, Catechugerbsäure, Moringerbsäure, Catechinsäure, ferner Gallussäure und andere aromatische Oxysäuren behandelt werden. Die Farbstoffe lösen sich in Alkali mit rotvioleter bis blauvioleter Farbe, in verdünnten Mineralsäuren fuchsinrot. Mit Thonerde- oder Zinnbeizen auf Baumwolle gedruckt, liefern sie violete Nüancen.

3. Phenolfarbstoffe.

Farbwerke vorm. Meister, Lucius & Brüning in Höchst a. M. stellen Alphanaphtylamintrisulfosäure dar und verwenden dieselbe zur Gewinnung eines gelben Farbstoffes, der Binitronaphtolmonosulfosäure. (D. P. 22545 vom 2. September 1882.) Das α-Naphtylamin wird zunächst in die Monosulfosäure verwandelt. Man trägt dann einen Teil der schwer lös-

*) Techn.-chem. Jahrb. 1883, S. 332.
**) Vgl. Techn.-chem. Jahrb. 1883, S. 332.

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lichen Alphanaphtylaminmonosulfosäure unter Abkühlung mit kaltem Wasser in drei bis 4 Teile rauchender Schwefelsäure (40 Proc. SO^3) ein und erhitzt diese Mischung langsam auf 120°, bei welcher Temperatur das Erhitzen noch 6 bis 10 Stunden fortgesetzt wird. Das Sulfonirungsproduct wird in kaltes Wasser gegossen. Durch Neutralisiren mit Kalkmilch erhält man das Calciumsalz der Alphanaphtylamintrisulfosäure. Die Trisulfosäure wird nun mit einem Gemisch von salpetriger Säure und Salpetersäure behandelt:

$$C^{10}H^4(SO^3H)^3NH^2 + HNO^2 + 2\,HNO^3 + H^2O = C^{10}H^4(NO^2)^2SO^3H \cdot OH + 2\,SO^4H^2 + 2\,H^2O + N^2.$$

10 kg alphanaphtylamintrisulfosaurer Kalk, 3 bis 4 kg salpetrigsaures Natron und 6 kg Chilisalpeter werden in 30 l Wasser kochend gelöst, dann wird eine ebenfalls kochende Mischung von 8 kg Schwefelsäure mit 8 kg Wasser in jene Lösung eingegossen. Sobald die unter Rotgelbfärbung entstehende starke Stickstoffentwickelung aufgehört hat, wird mit Potasche neutralisirt. Es entsteht ein dicker, gelbbrauner Brei von dem in Wasser schwer löslichen Kaliumsalz der Binitronaphtolmonosulfosäure, der abgepresst und umkrystallisirt wird. Das Natriumsalz dieser Säure bildet einen schön gelben Farbstoff.

Charles A. Seltzer in Basel stellt Nitrosoalphanaphtoldisulfosäure unter Benutzung des im D. P. 10785*) der Bad. Anilin- und Sodafabrik geschützten Verfahrens der Darstellung von Sulfosäuren des Alphanaphtols her. (D. P. 20716 vom 20. Januar 1882.) Man setzt zu der wässerigen Lösung des Einwirkungsproductes von rauchender Schwefelsäure auf Alphanaphtol salpetrigsaures Natrium. Es entsteht glatt Nitrosonaphtoldisulfosäure $C^{10}H^4(OH)\alpha(NO)(SO^3H)^2$. Die Salze dieser Säure färben Wolle und Seide im sauren Bade lebhaft gelb. Durch Kochen mit Salpetersäure wird die Nitrosonaphtoldisulfosäure in Binitronaphtolmonosulfosäure verwandelt.

In Bezug auf die „Indophenole" genannten Farbstoffe**) sind einige Neuerungen hervorzuheben. Statt, wie früher angegeben, Gemische von Phenolen und Paradiaminen zu oxydiren, kann man nach dem D. P. 19231 vom 26. October 1881 (Leop. Cassella & Co. in Frankfurt a. M.) durch Oxydation von Gemischen von Paraamidophenolen und Monaminen zu gleichartigen Farbstoffen, sog. Indophenolen, gelangen.

Beispiel: 15 kg salzsaures Paraamidophenol werden in 250 l Wasser gelöst und mit der Lösung von 16 kg salzsaurem Dimethylanilin in 100 l Wasser versetzt, und dann wird eine Lösung von 200 kg Kaliumbichromat langsam zugefügt.

Der entstandene grünblaue Farbstoff ist in kaltem Wasser schwer, in verdünnten Säuren leicht löslich; er wird durch vorsichtiges Neutralisiren abgeschieden und als Paste oder getrocknet oder auch in reducirtem Zustande als Leukoverbindung in den Handel gebracht. Durch Oxydation in sauren

*) Techn.-chem. Jahrb. 1881, S. 271.

**) Köchlin und Witt, D. P. 15915; Cassella, D. P. 18903 in Techn.-chem. Jahrb. 1883, S. 334 f.

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Lösungen gelangt man nach diesem, wie nach dem im Haupt-Patent angegebenen Verfahren zu Salzen, die gegen Säureeinwirkung unempfindlich sind.

In dem D. P. 20850 vom 31. Mai 1882 geben Leopold Cassella & Co. in Frankfurt a. M. eine neue Methode der Darstellung von Indophenol. Dieselbe beruht auf der bisher unbekannten Eigentümlichkeit des Alphabibrom- (und bichlor-) naphtols bei Gegenwart von Br H (oder Cl H) entziehenden Mitteln (Alkalien, Ammoniak, aromatischen Aminen oder Phenolen), Brom zu verlieren und unter diesen Umständen ganz ebenso wie Bromüre der Fettreihe zu Condensationen Veranlassung zu geben. Erwärmt man Alphabibromnapthol (Schmelzp. 111°, Ber. der d. chem. Ges. 6, S. 1119, Biedermann) auf dem Wasserbade mit einer wässerigen Lösung von Dimethylparaphenylendiamin unter Zusatz von kohlensaurem oder kaustischem Natron, so dass die Flüssigkeit stets alkalisch bleibt, so bildet sich ein rein blauer Niederschlag von Indophenol, welches mit dem nach anderen Methoden dargestellten durchaus identisch ist. Die von demselben abfiltrirte Flüssigkeit ist eine alkalische Lösung von Leukoindophenol, aus der durch Einleiten von Luft oder Zusatz von Oxydationsmitteln noch mehr Indophenol gefällt werden kann.

Ferner wird daselbst folgendes über die Reinigung von Indophenol angegeben. Das nach einer der früher angegebenen Methoden bereitete Indophenol enthält stets geringe Mengen des von Meldola beschriebenen, durch Einwirkung von Nitrosodimethylanilin auf Alphanaphtol in essigsaurer Lösung entstehenden violetten Farbstoffs. Diese Verunreinigung genügt, um die Eigenschaften des Indophenols wesentlich zu verändern. Zur Entfernung dieser störenden Beimengung wird rohes Indophenol mit einprocentiger Schwefelsäure behandelt, so lange dieselbe sich noch rot färbt. Indophenol bleibt nach dem Aussüssen mit Wasser als unlöslicher, rein blauer Rückstand, während die sauren, roten Waschwasser den Meldola'schen Farbstoff als Sulfat enthalten. Das so erhaltene reine Indophenol ist in Alkohol mit rein blauer Farbe löslich, durch Säuren wird es nicht zersetzt, sondern geht mit denselben höchst unbeständige, salzartige Verbindungen ein, welche schon von viel Wasser, leichter von Alkalien in freies Indophenol und freie Säure gespalten werden. In Alkohol oder angesäuertem Wasser lösen sich die Verbindungen mit rein gelber Farbe; den wässerigsauren Lösungen entziehen schon Lösungsmittel, wie z. B. Aether, freies Indophenol.

Die Erfinder führen noch an, dass sie sämtliche Methoden der Indophenolbildung ausser auf Alphanaphtol und Phenol einerseits und Dimethylparaphenylendiamin andererseits auch angewendet haben auf folgende Phenole: Orthokresol, Parakresol, Resorcin, Orcin, Betanaphtol; und folgende Diamine: Paraphenylendiamin, Monäthylparaphenylendiamin, Diäthylparaphenylendiamin (symmetrisch), Dimethylparaphenylendiamin, Mono- und Diisobutylparaphenylendiamin, Mono- und Diamylparaphenylendiamin, Paratoluylendiamin, Xylendiamin, Diäthylparaphenylendiamin (symmetrisch), ohne unter den zahlreichen, durch die Combination der verschiedenen genannten Ingredienzien

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erhaltenen Farbstoffen irgend welche zu finden, die an Schönheit, Ausgiebigkeit oder Billigkeit die typischen Producte überträfen. Was die Färbung anbelangt, so variirt dieselbe von braun durch rot und violet bis blaugrün. Dieselbe wird mehr durch die Wahl des Phenols als durch die des Diamins beeinflusst.

Ad. Winther in Giessen. Darstellung von Orcin. (D. P. 20713 vom 25. October 1881.) Von der Voraussetzung ausgehend, dass das Orcin Dioxytoluol sei, dessen beide Hydroxylgruppen in der Metastellung zu der Methylgruppe sich befinden, beansprucht der Patent-Inhaber die Darstellung von Orcin aus den Toluolderivaten, welche zwei in Hydroxyl umwandelbare Gruppen in der genannten Beziehung zu der Methylgruppe enthalten.

Dasselbe Verfahren hat Ralph H. Ch. Nevile in England patentirt. (Engl. P. 4389 vom 8. October 1881.) Der Weg von Metadinitrotoluol über m-Nitro-m-Amidotoluol, m-Nitrokresol, m-Amidokresol zum Orcin ist weitläufig. Schmelzen von m-Bromtoluol-m-Sulfosäure oder Dibromtoluol mit mit Alkali ist das von Vogt und Henninger angegebene Verfahren (Bull. soc. chim. **21.** 373). Auch die Umwandlung von m-Brom-m-Amidotoluol in m-Bromkresol und Behandlung derselben mit Kalihydrat zur Ersetzung des Broms durch Hydroxyl wird beansprucht, ferner wird Orthoamidotoluolmetasulfosäure oder Paraamidotoluolmetasulfosäure als Ausgangspunkt genommen, indem dieselben zuerst in die Disulfosäuren übergeführt werden, dann die NH_2-Gruppe durch Bildung und Zersetzung der Diazoverbindung verlieren und dann mit Kalihydrat geschmolzen werden. Dies kommt also wieder auf das Verfahren von Vogt und Henninger hinaus.

H. Brunner hat Resorcin (2 Tle.) mit Nitrobenzol (1 Tl.) unter Einwirkung von 20 Tln. conc. Schwefelsäure bei 150° mit einander combinirt. Beim Behandeln der blauvioletten Schmelze mit kaltem Wasser scheidet sich ein rotbraunes Pulver aus, während ein Teil sich löst. Pulver und Lösung geben mit Basen, Ammoniak z. B., eine fuchsinrote, wie Magdalarot zinnoberrot fluorescirende Flüssigkeit. Die Alkalisalze färben Seide, Wolle und Baumwolle rosa, in saurer Lösung gelb bis orange. Bei Wasserbadtemperatur verändern sich die Salze, sie lösen sich dunkelrot auf. Aus diesen Salzen löst Alkohol den früheren fluorescirenden Körper. (Ber. chem. Ges. 1882, S. 1174.)

Anwendung des Coeruleins*) in der Wollfärberei. Wie Amaury de Montlaur angiebt, ist der Preis des Coeruleins auf $3^1/_2$ Frcs. per Kilogramm herabgegangen und 1 kg Wolle kann jetzt für 1 Frc. damit gefärbt werden. Um damit zu färben, wird der Farbstoff mit dem gleichen Gewicht Natriumbisulfit zusammengerührt. Dann wird $^1/_{10}$ des Gewichts Zinkstaub zugesetzt, und nach einigem Stehenlassen wird die Masse in das Färbebad gebracht und die Temperatur erhöht. Wenn die Wolle mit Alaun und Weinstein gebeizt ist, so erhält man schöne Grüns mit einem Stich ins Olivenfarbene. Ein Seifebad macht die Nuance heller. Chrombeizen geben.

*) Techn.-chem. Jahrb. 1880, S. 322; 1881, S. 270; 1882, S. 361.

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noch schönere und intensivere Farben. Die Alaune in dem Bad dürfen nicht sauer sein. Nach gelindem Kochen, wobei die Luft möglichst abgeschlossen und event. Zink hinzugefügt wird, nimmt man die Wolle heraus, ringt aus und lässt sie in dünner Schicht der Oxydation an der Luft ausgesetzt. Nach 12 bis 15 Stunden kann sie gewaschen werden.

4. Azofarbstoffe.

Die Actiengesellschaft für Anilinfabrikation in Berlin stellt gelbe, braune und rotbraune Farbstoffe durch Paarung der Diazoverbindungen mit den vom Resorcin ableitbaren Azoverbindungen her (D. P. 18861 vom 9. August 1881).

Die Diazoverbindungen des Resorcins und der Homologen können sich wiederum mit einer Diazoverbindung paaren, so dass Oxybiazokörper entstehen*) von der Formel $\frac{R^1.N^2}{R^2.N^2} > C^6H^2(OH)^2$.

Als Beispiel wird angeführt: 93 kg Anilin werden diazotirt und mit 110 kg Resorcin gepaart; das Product wird in Natronlauge gelöst und nochmals gepaart mit Diazosulfanilsäure, welche aus 173 kg Sulfanilsäure bereite ist. Der dunkelbraune Farbstoff wird durch Aussalzen gewonnen. Er ist löslich in Wasser. Aus Nitranilin, Orcin und Naphtylaminsulfosäure erhält man einen schönen gelbbraunen Farbstoff, ebenso aus Amidobutylphenelmethyläther, Resorcin und Xylidinsulfosäure u. s. w.

O. Wallach hat in Gemeinschaft mit B. Fischer die Untersuchungen über die „Disazoverbindungen"*) fortgesetzt. Wenn Diazobenzolchlorid in eine kalische Lösung von Azobenzolresorcin eingetragen wird, so entstehen zwei isomere Farbstoffe, das α- und β-Resorcindisazobenzol, $(C^6H^5N^2)^2C^6H^2(OH)^2$. Die α-Verbindung schmilzt bei 213—215°, löst sich in Natronlauge mit bordeauxroter Farbe, in concentrirter Schwefelsäure mit roter Farbe Die β-Verbindung schmilzt bei 220°, ist in wässeriger Natronlauge unlöslich, in alkoholischem Kali mit braunroter Farbe löslich, in concentrirter Schwefelsäure mit indigoblauer Farbe. Die α-Verbindung giebt mit Essigsäureanhydrid ein Diacetylderivat vom Schmelzpunkt 183—184°, die β-Verbindung nicht.

Durch Eintragen einer Lösung von Natriumnitrit in eine essigsaure Lösung eines Gemisches von 1 Mol. Amidoazobenzol und 1 Mol. Resorcin entsteht als braunrotes Pulver, das den Resorcindisazobenzolen isomere Benzoldisazobenzolresorcin, $C^6H^5N^2 \cdot C^6H^4 \cdot N^2 \cdot C^6H^3(OH)^2$, in ebenfalls zwei isomeren Modificationen. Die α-Verbindung wird dem Gemenge durch Alkohol entzogen und bildet ein braunrotes Pulver vom Schmelzpunkt 183—184°, welches sich in concentrirter Schwefelsäure mit carminroter Farbe löst. Die β-Verbindung, ein braunrotes Pulver vom Schmelzpunkt 215°, ist in Alkohol und wässerigen Alkalien unlöslich, in alkoholischem Kali mit blauvioleter, in concentrirter Schwefelsäure mit rein blauer Farbe löslich.

*) Vgl. Wallach, Techn. chem. Jahrb. 1883, S. 335.

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Durch Einwirkung von p-Diazotoluolchlorid auf Azotoluolresorcin $C^7H^7N^2C^6H^3(OH)^2$ entsteht das analoge Product, Resorcindisazobenzoltoluol $\begin{matrix}C^7H^7N^2\\C^6H^5N^2\end{matrix}>C^6H^2(OH)^2$, aber in drei isomeren Modificationen. Die α-Verbindung schmilzt bei 195—196°, in Alkali löslich, giebt eine bei 175° schmelzende Acetylverbindung; die α^1-Verbindung schmilzt bei 241°, sieht aus wie Musivgold, ist in Alkali schwer löslich und giebt ein bei 195—196° schmelzendes Acetylderivat; die β-Verbindung ist in Alkalien unlöslich, bildet braunschwarze bei 204—206° schmelzende Blättchen.

Auch diazotirtes Paratoluidin lässt sich (entgegen der früheren Angabe im vorigen Jahrg. S. 336) mit Resorcinazo-p-toluol paaren zu Resorcindisazo-p-toluol $(C^7H^7N^2)^2C^6H^2(OH)^2$. Dies bildet eine α-Modification in gelben Nadeln vom Schmelzpunkt 255° und eine β-Verbindung vom Schmelzpunkt 202—204°.

Diazotirtes Orthotoluidin giebt mit Resorcinazoorthotoluol (Schmelzpunkt 175°) Resorcindisazoorthotoluol, dessen α-Modification Nadeln vom Schmelzpunkt 194—195° bildet (Ber. chem. Ges. **15**, 2814).

Weiter hat Wallach aus dem monoacetylirten Toluylendiamin durch Behandeln der salzsauren Lösung mit Natriumnitrit und Zusatz von Phenol die Verbindung $C^7H^6<\begin{matrix}NH\cdot C^2H^3O\\N^2\cdot C^6H^4OH\end{matrix}$ dargestellt; goldgelbe Blättchen vom Schmelzpunkt 252 bis 253°. Durch Kochen mit viel Salzsäure wird die Acetylgruppe abgespalten, und es entsteht Phenolazo-p-amidotoluol

$$C^7H^6<\begin{matrix}NH^2\\N^2C^6H^4OH,\end{matrix}$$

gelbbraune Nadeln vom Schmelzpunkt 172° Die Verbindung wird wiederum diazotirt und das Product in eine alkalische Phenollösung gegossen; es scheidet sich ein rotgelber Niederschlag, das Toluoldisazophenol

$$C^7H^6<\begin{matrix}N^2\cdot C^6H^4OH\\N^2\cdot C^6H^4OH,\end{matrix}$$

ab. Natürlich können auch andere Phenole in das Molecul eingeführt werden. Durch Paarung mit β-Naphtolsulfosäure erhält man einen löslichen, dem Ponceau ähnlichen Farbstoff. (Ber. chem. Ges. 15, 2825.)

Nach demselben Verfahren haben Wallach und E. Schulze aus dem acetylirten Phenylendiamin analoge Verbindungen dargestellt. Monoacetphenylendiamin bildet leicht lösliche blätterige Krystalle; Phenolazoacetamidobenzol, $C^6H^4<\begin{matrix}NH\cdot C^2H^3O\\N^2\cdot C^6H^4OH\end{matrix}$ ist ziegelrot, Schmelzpunkt 208°; Phenolazoamidobenzol $C^6H^4<\begin{matrix}NH^2\\N^2C^6H^4OH\end{matrix}$ braungelb, Schmelzpunkt 168°; Benzoldisazophenol $C^6H^4<\begin{matrix}N^2\cdot C^6H^4OH\\N^2\cdot C^6H^4OH\end{matrix}$ dunkles in Natronlauge leicht lösliches Pulver. (Ber. chem. Ges. 15, 3020.)

Farbwerke vorm. Meister, Lucius & Brüning in Höchst a. M. Darstellung bordeauxroter Tetrazofarbstoffe. (D. P. 22010 vom

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2. September 1882.) Als Vervollständigung der im D. P. 16485*) angeführten Verfahren zur Herstellung von Farbstoffen aus Diazoazobenzol oder dessen Homologen etc. wird die folgende Methode zur Darstellung bordeauxroter Farbstoffe aus Diazoazoxylol und den Disulfosäuren des Betanaphtols angeführt.

50 kg salzsaures Amidoazoxylol, in 200 kg Wasser suspendirt, werden unter Zusatz von 20 kg 33 Proc. HCl enthaltender Salzsäure mit 12 kg salpetrigsaurem Natron in salzsaures Diazoazoxylol übergeführt. Die so erhaltene Lösung der Diazoverbindung lässt man in eine Lösung von 60 kg betanaphtoldisulfosaurem Natron (sei es nun R-Salz, G-Salz oder ein Gemisch beider (vgl. D. P. 3229)**) in 200 kg Wasser und 14 kg 24 Proc. NH^3 enthaltendem Ammoniak langsam einfliessen. Der gebildete Farbstoff wird durch Kochsalz gefällt und in bekannter Weise gereinigt.

W. Harmsen in Waldhof bei Mannheim stellt gelbe, orange und rote Farbstoffe durch Paarung von diazotirten Basen mit aromatischen Oxysäuren und einer Betaoxynaphtoësulfosäure her. (D. P. 22707 v. 9. Sept. 1882.) Die Oxysäuren der aromatischen Reihe geben, wenn sie mit gleichen Moleculen diazotirter Basen vermischt werden, Farbstoffe, deren Farbe mit steigendem Kohlenstoffgehalt der Componenten von gelb bis rot variirt. Die Carboxylgruppe der Oxysäuren ist in den neuen Körpern unverändert erhalten. Die Farbstoffe, (Oxyazocarbonsäuren) lösen sich in Alkohol, während ihre Alkalisalze wasserlöslich sind und Wolle wie Seide direct waschecht färben. Die Mischung gleicher Molecule der diazotirten Basen und des Na-Salzes einer aromatischen Oxysäure wird durch Natronlauge alkalisch gemacht, wobei der Farbstoff als Salz in Lösung geht. Nachdem von einigen harzartigen Körper abfiltrirt ist, wird das Filtrat mit Kochsalz ausgesalzen, wobei der Farbstoff in Flocken ausfällt.

Gelbe Farbstoffe entstehen durch Paarung von 2 Teilen Anilin (nach Ueberführung in Diazobenzol) und 3 Metaoxybenzoësäure; ferner bilden gelbe Farben 3 Tle. Anilin mit 5 Oxymetatoluylsäure, 4 Tle. Toluidin mit 5 Oxybenzoësäure.

Orange Farbstoffe: 5 Tle. Anilin mit 9 Oxyisophtalsäure, 7 Tle. Toluidin mit 10 Oxytoluylsäure, 5 Tle. Toluidin mit 8 Oxyisophtalsäure, 6 Tle. Xylidin mit 7 Oxybenzoësäure, 4 Tle. Xylidin mit 5 Oxytoluylsäure, 8 Tle. Xylidin mit 11 Oxyisophtalsäure, 1 Tl. Cumidin mit 1 Oxybenzoësäure, 9 Tle. Cumidin mit 10 Oxytoluylsäure, 9 Tle. Cumidin mit 11 Oxyalsäure.

Scharlachrote Farbstoffe: 1 Tl. Anilin mit 2 β-Oxynaphtoësäure, 7 Tle. Toluidin mit 12 β-Oxynaphtoësäure, 1 Tl. Naphtylamin mit 1 Oxybenzoësäure, 14 Tle. Naphtylamin mit 15 Oxytoluylsäure.

Ponceaurote Farbstoffe: 5 Tle. Xylidin mit 8 β-Oxynaphtoësäure,

*) Krügener im Techn.-chem. Jahrb. 1883, S. 338.
**) Techn.-chem. Jahrb. 1880, S. 318; 1881, S. 272.

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9 Tle. Cumidin mit 14 Oxynaphtoësäure, 6 Tle. Naphtylamin mit 7 Oxyisophtalsäure.

Kirschrote Farbstoffe: 3 Tle. Naphtylamin mit 4 β-Oxynaphtoësäure.

Da die Natriumsalze der vom Naphtylamin abzuleitenden Farbstoffe in Wasser nur schwierig löslich sind, so führt man diese in die Sulfosäuren über. Die freie Säure wird mit dem doppelten Gewicht Schwefelsäure vom spec. Gew. 1·8 2 Stunden lang auf 160° erhitzt. Die tiefblaue Lösung wird in die vierfache Menge Wasser gegossen, wobei sich die besonders in verdünnter Schwefelsäure schwer lösliche Sulfosäure abscheidet.

Die roten Farbstoffe, welche sich von der β-Oxynaphtoësäure (durch Ueberleiten von Kohlensäure über β-Naphtolnatrium bei 280° und Ausfällen des in Wasser gelösten Rückstandes mit Salzsäure erhalten) ableiten, führt man dadurch bequem in die Sulfosäuren über, dass man an Stelle der Oxynaphtoësäure deren Sulfosäure anwendet. Die Oxynaphtoësäure wird in concentrirter Schwefelsäure gelöst und einige Zeit lang bei 150° erhitzt. Man stellt das saure Calciumsalz dar, aus diesem das Natriumsalz, welches mit diazotirtem Anilin und Toluidin scharlachrote, mit Xylidin und Cumidin ponceaurote und mit Naphtylamin dunkelkirschrote Lösungen giebt. Diese werden mit Natronlauge neutralisirt, abfiltrirt und ausgesalzen. Besonders die auf letztere Weise erhaltenen Farbstoffe zeichnen sich durch grosse Schönheit, Echtheit und Färbekraft aus.

P. Griess hat die Diazobenzolsulfosäure mit primären aromatischen Amidoverbindungen combinirt (Ber. chem. Ges. 1882, S. 2183). Mit salzsaurem Anilin entsteht ausser Diazobenzol und Sulfanilinsäure Azoamidobenzolsulfosäure, $C^{12}H^8 \cdot SO^3H \cdot NH^2$*). Aus dieser kann durch rauchende Schwefelsäure die Disulfosäure gewonnen werden, welche Wolle und Seide schön gelb färbt. Paradiazobenzolsulfosäure liefert, mit α-Amidonaphtalinsulfosäure in verdünnter Kalilauge zusammengebracht, nach dem Ansäuern mit Essigsäure und Kochen die Azo-α-Amidonaphtalinsulfo-Parabenzolsulfosäure $C^6H^4 \cdot SO^3H \cdot N^2 \cdot \alpha N^{10}H^5 \cdot SO^3H.NH^2$, die in Wasser und Alkohol löslich ist und Wolle und Seide orange färbt.

Dahl & Co. in Barmen stellen gelbe Farbstoffe in folgender Weise her: (D. P. 21908 vom 25. März 1882.) Während die Phenylamidoazobenzolmonosulfosäuren rötlich gelb färben, liefern die Tri- und Tetrasulfosäuren rein gelbe Töne. Die Homologen färben orange. Die Polysulfosäuren entstehen aus Phenylamidoazobenzol, $C^6H^5 \cdot HN \cdot C^6H^4 \cdot N^2 \cdot C^6H^5$, durch Einwirkung rauchender Schwefelsäure von 20 Proc. SO^3 Gehalt, oder von Schwefelsäurechlorydrin, oder von Schwefelsäure und Alkalipyrosulfaten bei gelinder Erwärmung. Statt des Phenylamidoazobenzols wendet man zweckmässig die mit Hülfe von Sulfanilsäure dargestellte Monosulfosäure derselben an. Die Farbstoffe werden als Alkalisalze benutzt.

Actiengesellschaft für Anilinfabrikation in Berlin. Verfahren zur

*) Graessler im Techn.-chem. Jahrb. 1883, S. 340.

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Darstellung brauner Azofarbstoffe aus Chrysoidinen und Diazoverbindungen. (D. P. 22714 vom 8. November 1882.) Die Chrysoidine z. B. salzsaures Diamidoazobenzol, deren Sulfo- und Carbonsäuren können sich mit einem zweiten Molecül einer diazotirten Base oder Amidosäure paaren und Farbstoffe vom Typus des Phenylendiamindiazobenzols:

$$\left.\begin{matrix} C^6H^5N^2 \\ C^6H^5N^2 \end{matrix}\right\rangle C^6H^2 \left\{\begin{matrix} [1]NH^2 \\ [3]NH^2 \end{matrix}\right. \text{ liefern.}$$

Dadurch wird erzielt, dass die gelbe bis gelbrote Nüance der Chrysoidine in eine bräunliche übergeführt wird. So liefert das gewöhnliche Chrysoidin durch Vereinigung mit Diazobenzochlorid einen braunen Farbstoff, welcher fast die Nüance des Triamidolazobenzols (Bismarckbrauns) besitzt. Die Diazoverbindungen des Toluols, Xylols oder Cumols liefern ähnliche Farbstoffe von mehr rötlicher Nüance. Die aus α- und β-Naphtylamin und aus Amidoazobenzol erhaltenen Diazoverbindungen geben dunkler färbende Substanzen. Gewöhnlich sind die aus den basischen Chrysoidinen und Diazoverbindungen entstehenden Farbstoffe in Wasser unlöslich, aber in Alkohol löslich. Um derartige Substanzen in Farbstoffe zu verwandeln, welche in Wasser löslich sind, führt man sie in Sulfosäuren über, oder man geht von einer Chrysoidinsulfosäure oder Chrysoidincarbonsäure aus und lässt auf solche Substanz das Salz einer Diazoverbindung oder eine diazotirte Amidosäure einwirken. Oder man bringt ein Chrysoidin mit einer diazotirten Amidosäure zusammen. Zur näheren Erläuterung des Verfahrens dienen folgende Beispiele:

a) 10 kg Sulfanilsäure werden in 300 l Wasser verteilt und mit 3·6 kg Natriumnitrit und 6 kg Salzsäure von 22° B. versetzt. In diese Lösung lässt man eine Lösung von 6 kg m-Phenylendiamin in 300 l Wasser einfliessen und fügt 7 kg Natronlauge von etwa 40° B. hinzu. Das so entstandene Natriumsalz der Chrysoidinsulfosäure wird darauf mit einer Lösung von Diazobenzolchlorid, welche aus 6·5 kg Anilin, 12 kg Salzsäure und 3·6 kg Natriumnitrit bereitet ist, gemischt, dann mit 7 kg Natronlauge versetzt; der Farbstoff wird nach dem Filtriren ausgesalzen oder die Lösung abgedampft.

b) Eine isomere Säure erhält man, wenn man die Diazoverbindung aus Anilin und Sulfanilsäure in umgekehrter Reihenfolge auf Phenylendiamin einwirken lässt.

c) Wendet man statt 6·5 kg Anilin in vorstehenden Vorschriften 10 kg Sulfanilsäure an, so erhält man die entsprechende Disulfosäure.

Farbwerke, vorm. Meister, Lucius & Brüning in Höchst a. M. Darstellung von Azofarbstoffen aus den Trisulfosäuren des Betanaphtols. (D. P. 22038 vom 26. Mai 1882.) Um die Betanaphtoltrisulfosäure darzustellen, setzt man zu 4 bis 5 Teilen rauchender Schwefelsäure von 20 Proc. SO^3 Gehalt 1 Teil Naphtol, wobei die Temperatur der Mischung auf 140 bis 160° steigt und solange aufrecht erhalten wird, bis eine Probe mit Ammoniak eine Lösung von rein grüner Fluorescenz und mit Diazoxylol in alkalischer Lösung erst nach einiger Zeit einen Farbstoff liefert.

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Mit der Trisulfosäure werden die verschiedensten Diazoverbindungen in gebräuchlicher Weise combinirt. Die Diazoverbindung der Alphanaphtylaminsulfosäure liefert einen schön roten Farbstoff, die Diazoverbindung des Amidoazobenzols oder deren Sulfosäure blaurote Farbstoffe. Der beim Vermischen der Componenten sich ausscheidende voluminöse Niederschlag wird durch Auflösen in Wasser und Aussalzen gereinigt.

Die Farbenfabriken vorm. Friedrich Bayer & Co. in Elberfeld haben die Herstellung brauner Farbstoffe, Amidonaphtalintetrazobenzolsulfosäuren, patentirt. (D. P. 20000 vom 21. März 1882.) Diazoazobenzolsulfosäuren werden mit α- oder β- Naphtylamin combinirt. Als Beispiel wird angegeben: 50 kg amidoazobenzolsulfosaures (am besten disulfosaures) Natron werden in 1000 l Wasser gelöst und durch Zusatz von 50 kg Salzsäure und 10 kg salpetrigsaurem Natron diazotirt. Die entstandene Diazoazobenzolsulfosäure giesst man nach längerem Stehen in eine Lösung von 21 kg Naphtylamin (α oder β) und 50 kg Salzsäure in 1000 l Wasser ein. Der sich sofort niederschlagende braune Farbstoff wird auf Filtern gesammelt, in das Ammoniak- oder Natronsalz übergeführt und getrocknet.

In dem Verfahren zur Herstellung des Croceïn-Scharlach des Croceïn-Gelb etc.*) haben die Farbenfabriken vorm. Friedr. Bayer & Co. in Elberfeld insofern eine Neuerung angebracht (D. P. 20397 vom 18. Januar 1882) als anstatt der englischen Schwefelsäure von 66° B. auch ein Gemisch von dieser mit einigen Procenten Schwefelsäureanhydrid oder Schwefelsäuremonochlorhydrin zur Sulfurirung des Naphtols angewendet werden kann.

Die im D. P. 18027*) beschriebene Alphamonosulfosäure des Betanaphtols combiniren die Farbenfabriken vorm. Friedr. Bayer & Co. in Bielefeld nach dem D. P. 20402 vom 30. März 1882 mit der Alphadiazonaphtalinmonosulfosäre zur Herstellung eines roten Farbstoffes.

Das Verfahren ist folgendes: 22·3 kg Alphanaphtylaminmonosulfosäure werden in 500 l Wasser und 25 kg Salzsäure fein suspendirt und durch allmäligen Zusatz von 7 kg Natriumnitrit in die Alphadiazonaphtalinmonosulfosäure übergeführt. Nach mehrstündigem Stehen lässt man die Flüssigkeit in eine bis zum Schluss schwach alkalisch zu haltende Lösung von 50 kg alphamonosulfosaurem (aus Spiritus krystallisirtem) Natronsalz des Betanaphtols in 200 l Wasser einlaufen. Es bildet sich sofort eine tiefrote Farblösung, aus welcher durch Salz der Farbstoff gefällt wird; derselbe wird durch wiederholtes Umlösen und Aussalzen gereinigt. Der so erhaltene Farbstoff färbt Wolle und Seide echt scharlachrot.

Die Anwendung der Lauth'schen Reaction — Darstellung blauer Farbstoffe durch Oxydation bei Gegenwart von Schwefelwasserstoff — wird noch immer in neuen Modificationen ausgeführt. Den früher angegebenen Verfahren**) sind noch die folgenden hinzuzufügen.

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*) Techn.-chem. Jahrb. 1883, S. 340.

**) Techn.-chem. Jahrb. 1880, S. 312; 1882, S. 356; 1883, S. 342.

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Rafael Meldola in London (Engl. P. 2471 vom 24. Mai 1882) wendet dieselbe auf gewisse Diazofarben an, die sich von den Amidosulfosäuren des Naphtalins und von tertiären Monaminen ableiten. β-Amidonaphtalinsulfosäure wird in die Diazoverbindung umgewandelt und diese lässt man auf Dimethylanilin oder dergleichen einwirken, so dass man einen Körper von der Formel $C^{10}H^6 \cdot HSO^3 \cdot N^2 \cdot C^6H^4 \cdot N < \begin{matrix} CH^3 \\ CH^3 \end{matrix}$ erhält. Derartige Körper sind alle orange Farbstoffe. Die ammoniakalische Lösuug, welche das Ammoniumsalz der Diazofarbstoffe suspendirt enthält, wird mit einer Lösung von gelbem Schwefelammon vermischt und bei 80 bis 90° erwärmt, bis der Farbstoff völlig reducirt ist. Durch Zusatz von etwas Zinkstaub wird die Reduction beschleunigt. Nach rascher Abkühlung wird angesäuert. Die Fällung von Schwefel und Amidonaphtalinsulfosäure wird abfiltrirt. Die Lösung wird dann mittelst Eisenchlorids oxydirt, bis der Farbstoff sich bildet, der durch Zusatz von Chlorzink und Kochsalz ausgesalzen wird. Der Farbstoff wird durch Filtriren von einem löslichen roten Körper befreit, in heissem Wasser gelöst und wiederum ausgesalzen wird; er färbt die Gespinnstfasern schön blau.

J. F. Espenschied in Friedrichsfeld (D. P. 19841 vom 14. Juni 1881) führt die primären, secundären und tertiären Diamidoderivate des Azoxybenzols und Azobenzols durch Schwefelwasserstoff, schweflige Säure oder andere schwache Reductionsmittel in die entsprechenden Hydrazoverbindungen über. Diese liefern bei Gegenwart von Schwefelwasserstoff mit schwachen Oxydationsmitteln blaue Farbstoffe. — Beispiel: Man löst 10 Teile Tetramethylparadimidoazoxybenzol $(CH^3)^2N \cdot C^6H^4 \cdot N^2O\,C^6H^4 \cdot N(CH^3)^2$ in 80 Teilen Salzsäure und 2000 Teilen Wasser in der Kälte auf und leitet in die rote Lösung so lange Schwefelwasserstoff, bis die Flüssigkeit entfärbt ist. Behandelt man jetzt die Flüssigkeit mit Eisenchloridlösung von 20° B., so bilden sich ein blauer und ein roter Farbstoff. Durch Zusatz von Chlorzink und Kochsalz wird ersterer gefällt. Man reinigt ihn nach bekannter Art. Er färbt grünstichig blau. Die Lösung des roten Farbstoffes wird nach dem D. P. 14581 mit Zink und Eisenchlorid behandelt*) und liefert dann eine weitere Menge von demselben Farbstoff. Anstatt in die Lösung des Tetramethylparadiamidoazoxybenzols Schwefelwasserstoff einzuleiten, kann man diesen auch in der Lösung selbst durch Eintragen von Schwefelnatrium, Schwefelbarium, Schwefelcalcium, Schwefeleisen, Schwefelzink etc. erzeugen. Das Tetramethyldiamidoazoxybenzol kann auch in salzsaurer Lösung mit unterschwefliger Säure oder anderen Thiosäuren behandelt und dann direct oxydirt werden.

Lembach & Schleicher in Biebrich a. Rh. stellen einen schwefelhaltigen blauen Farbstoff aus Diäthylanilinazobenzolparasulfosäure her. (D. P. 23278 vom 3. December 1882.) Giesst man ein Molecül (14·9 kg) Diäthylanilin allmälig in eine stets schwach sauer gehaltene wässerige Lösung von 1 Molecül p-Diazobenzolsulfosäure, so scheidet sich die in kaltem Wasser

*) Techn.-chem. Jahrb. 1882, S. 357.

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schwer lösliche Diäthylanilinazobenzolparasulfosäure $C^6H^4(SO^3H)N^2.C^6H^4.N(C^2H^5)^2$ in violetten Nadeln aus. Diese Verbindung, welche als Ausgangsproduct zur Gewinnung des neuen blauen Farbstoffes dient, löst man in überschüssigem Ammoniak und trägt in die gelbe Lösung bis zur vollständigen Entfärbung Zinkstaub ein. Dabei bildet sich die Hydrazoverbindung $C^6H^4(SO^3H)NH—NH.C^6H^4.N(C^2H^5)^2$. Man erwärmt darauf, filtrirt von nicht verbrauchtem Zinkstaub ab, säuert das Filtrat mit Schwefelsäure an und sättigt es nach dem Erkalten mit Schwefelwasserstoff. Auf Zusatz von Eisenchlorid färbt sich die Flüssigkeit zuerst grün, dann tiefblau. Man giebt Chlorzink zu und salzt den neuen Farbstoff mit Kochsalz aus. Das Filtrat enthält einen violeten Farbstoff und Sulfanilsäure. Nach dem Trocknen bildet der Farbstoff ein in kaltem Wasser mit blauer Farbe lösliches braunes Pulver, welches Seide, Wolle und Baumwolle schön grünblau färbt.

Von diesem Patent unterscheidet sich kaum ein Verfahren von Otto Mühlhäuser in Farbwerk Griesheim a. M. welcher nach dem D. P. 23291 vom 5. Januar 1883, die Lauth'sche Reaction auf die Substitutionsproducte secundärer und tertiärer aromatischer Amine anwendet. Besonders werden die Sulfosäuren der alkylirten Amidoazoderivate des Toluols und Anisols benutzt, also Körper von der Formel

$$HSO^3.C^6H^4.N^2.C^6H^3<\begin{matrix}CH^3\\N<\begin{matrix}R\\R^1\end{matrix}\end{matrix} \text{ oder}$$

$$HSO^3.C^6H^4.N^2.C^6H^3<\begin{matrix}OCH^3\\N<\begin{matrix}R\\R^1\end{matrix}\end{matrix},$$

wo R und R^1 Alkoholradicale sind. So erhält man aus Dimethylamidomethylazobenzolsulfosäure durch Behandlung mit Schwefelwasserstoff und darauf folgende Oxydation einen blauen, aus dem entsprechenden Anisolkörper einen grünblauen Farbstoff.

Otto Bredt in Barmen hat die folgende Darstellung roter und gelber Farbstoffe patentirt. (Engl. P. 1730 vom 12. April 1882.) Alphanaphtylamin wird in die Sulfosäure umgewandelt; diese wird diazotirt und in der Menge von 1 Mol. in eine alkalische Lösung von 2 Mol. Naphtylaminsulfosäure gebracht. Dann wird Natriumnitrit hinzugesetzt und angesäuert. Die Hexazoverbindung wird dann mit β-Naphtol in alkalischer Lösung combinirt, nach dem Ansäuren wird der Farbstoff ausgesalzen. Die Naphtole können durch andere Phenole ersetzt werden.

C. Rumpff in Elberfeld stellt nach dem Engl. P. 1773 vom 14. April 1882 Farbstoffe dar durch Reaction der Sulfosäuren von Diazo- oder Tetrazoverbindungen auf α- oder β-Naphtylamin. Als Beispiel wird die Darstellung eines braunen Farbstoffs angegeben, indem man diazonaphtalinsulfosaures Natrium auf α- oder β-Naphtylamin in saurer Lösung einwirken lässt. Der Farbstoff ist in heissem Wasser löslich und krystallisirt beim Abkühlen der Lösung.

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5. Anthracenfarbstoffe.

Die Actiengesellschaft für Anilinfabrikation in Berlin stellt rote und braunrote Azofarbstoffe aus Anthrol, Anthrolsulfosäuren und Bioxyanthracenen*) dar (D. P. 21178 vom 26. Februar 1882).

Es wird beansprucht, je eines der links stehenden Anthracenderivate mit je einem der rechts stehenden Körper zu paaren.

Anthrol $C^{14}H^9 \cdot OH$.	1. Diazobenzol und Homologe, α- und β-Diazonaphtalin, Diazoanisol.
Anthrolsulfosäure.	2. Sulfosäuren der Körper No. 1.
Anthrolbihydrür $C^{14}H^{11}OH$	3. Diazoanthraminsulfosäuren, Diazoanthraminhydrürsulfosäure.
Anthrolhydrürsulfosäure	4. Diazoamidoazobenzol und Homologe.
α- und β-Oxyanthrol	5. Mono- und Disulfosäuren der Körper No. 4.

Die Sulfosäuren des Anthrols erhält man am besten durch Verschmelzen der Anthracendisulfosäuren, welche man durch Reduction der in der Alizarinfabrikation benutzten Anthrachinondisulfosäuren gewinnt, mit Kalihydrat. Bei der Kalischmelze erhält man eine Anthrolmonosulfosäure und ein Oxyanthrol. Jene löst sich in heissem Wasser, dieses nicht. Wenn eine alkoholische Lösung von Anthrol mit Natriumamalgam erwärmt wird, so bildet sich Anthrolbihydrür $C^{14}H^{11}OH$, welches in kleinen Nadeln von 132° Schmelzpunkt krystallisirt. Dieses lässt sich, im Gegensatz zu Anthrol, direct zur Darstellung einer Sulfosäure verwenden.

Anthramin verwandelt sich beim Kochen mit Zink und Salzsäure in Anthraminhydrür, welches aus heissem Wasser oder Alkohol in kleinen weissen Blättchen krystallisirt. Auch dieser Körper liefert leichter eine Sulfosäure als das Anthramin.

Die Farbstoffe, welche die Sulfurylgruppe enthalten, sind wasserlöslich, die übrigen alkohollöslich.

C. Liebermann und A. Hagen haben die Einwirkungsproducte von concentrirter Schwefelsäure auf Binitroanthrachinon untersucht (Ber. chem. Ges. 1882, S. 578). Binitroanthrachinon wird mit dem 15fachen Gewicht Schwefelsäure rasch auf 200° erhitzt. Beim Eingiessen der erkalteten Schmelze in Wasser scheidet sich ein braunroter Körper ab, der in Alkalien sich mit prachtvoll violeter Farbe löst. Bei der Behandlung des Niederschlags mit Barytwasser ergiebt sich ein in kaltem und ein in heissem Barytwasser löslicher Farbstoff. Letzterer färbt Seide rot. Zusammensetzung $C^{28}H^{18}NO^{27}$. Er ist als ein Amid des Erythrooxyanthrachinons und des Purpuroxanthins anzusehen.

Die Badische Anilin- & Soda-Fabrik in Ludwigshafen a. Rhein hat die Darstellung von in Wasser löslichen Verbindungen aus Alizarinblau und Sulfiten verbessert (D. P. 23008 vom 5. September 1882).**)

*) Vgl. Liebermann, Ber. Chem. Ges. XV., S. 510; Techn.-chem. Jahrb. 1883, S. 343.

**) Vgl. D. P. 17695 im Techn.-chem. Jahrb. 1883, S. 344.

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Zur Ueberführung von Alizarinblau in eine wasserlösliche Verbindung eignen sich statt der sauren schwefligsauren Alkalien ebenfalls die durch Auflösen der betreffenden Oxyde bezw. Hydrate und Carbonate in wässeriger schwefliger Säure darstellbaren Sulfite von Calcium, Barium, Strontium, Magnesium, Zink, Mangan, Aluminium, Chrom und Eisen, sowie die Doppelverbindungen genannter Sulfite mit den schwefligsauren Alkalien.

Die Einwirkung der Sulfite auf das Alizarinblau wird erheblich durch die Gegenwart von Lösungsmitteln des Alizarinblaues beschleunigt. Derartige Lösungsmittel sind Alkohol, Essigäther und Essigsäure; ein Zusatz derselben von 10—15 Proc. der Mischung genügt.

Mit Zinkstaub, hydroschwefliger Säure oder Traubenzucker erhält man bei Gegenwart verdünnter Natronlauge oder Kalilauge aus Alizarinblau eine gelbbraune Lösung, aus der sich der Farbstoff bei Gegenwart von Luft mit blauer Farbe wieder abscheidet. Wird diese Lösung bei abgehaltenem Luftzutritt mit einer Mineralsäure schwach übersättigt, z. B. schwefliger Säure, so scheidet sich die darin enthaltene Leuko- oder Hydroverbindung des Alizarinblaues ab. Diese Verbindung lässt sich nun, genau wie das Alizarinblau, in wasserlösliche Sulfitverbindungen überführen, welche nach dem Abscheiden in fester Form und Trocknen sich wie die entsprechenden, direct aus dem Alizarinblau dargestellten wasserlöslichen Farbstoffe verhalten. Wird die Reductionsküpe des Alizarinblaues mit verdünnter Salzsäure schwach übersättigt und dann mit Zinksulfitlösung oder der Lösung eines anderen der anfangs genannten Metallsulfite vermischt, so bilden sich die entsprechenden wasserlöslichen Metallverbindungen, welche durch Erhitzen über ungefähr 70° C. sich unter Abscheidung der entsprechenden Farblacke des Alizarinblaues zersetzen.

Nach C. Koenig in Höchst a. M. (Engl. P. 627 vom 9. Februar 1882.) kann zur Ueberführung des Alizarinblaus in die wasserlösliche Verbindung anstatt der Alkalibisulfite neutrales Ammoniumsulfit benutzt werden. Zehnprocentige Alizarinblaupâte wird mit einer concentrirten Lösung des neutralen Sulfits mehrere Tage lang bei 30—40° digerirt. Aus der gelben Lösung wird das wasserlösliche Alizarinblau dann durch Aussalzen gewonnen.

Der jährliche Gesammtverbrauch von Alizarin wird auf 7 Mill. kg geschätzt, deren Verkaufswert 40 Mill. M. beträgt. Das Rohmaterial, Anthracen, wird hauptsächlich von England geliefert, während Deutschland etwa 90 Proc. des Endproducts erzeugt. Uebrigens nimmt auch in Deutschland die Anthracengewinnung zu. (Färberz. 1882, 17.)

6. Indigo.

Neuerungen in dem Verfahren zur Darstellung des künstlichen Indigo's. Von der Badischen Anilin- und Sodafabrik in Ludwigshafen a. Rh. (Sechstes Zusatz-Patent zu No. 11857 vom 19. März 1880.) *) D. P. 19266 vom

*) Tech.-chem. Jahrb. 1882, 367 f; 1883, 347.

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23. December 1881. Der künstliche Indigo lässt sich auch nach folgendem Verfahren darstellen:

Orthonitrophenylacetylen, welches, wie bekannt, durch Kochen einer wässerigen Lösung der Orthonitrophenylpropiolsäure erhalten werden kann, wird durch Behandlung mit ammoniakalischem Kupferchlorür in die ebenfalls bekannte Kupferoxydulverbindung übergeführt. Diese wird darauf mit einer alkalischen Lösung von Ferricyankalium behandelt, wodurch das Orthodinitrodiphenyldiacetylen $C^6H^4\begin{cases}C\equiv C-C\equiv C\\NO^2\quad\quad NO^2\end{cases}C^6H^4$ erzeugt wird. Durch Behandlung des letzteren mit rauchender Schwefelsäure entsteht das isomere Diisatogen, welches sich durch Reductionsmittel in Indigblau, durch concentrirte Schwefelsäure und Eisenvitriol in Indoin überführen lässt. Das Dinitrodiphenyldiacetylen wird nach der Behandlung der Kupferverbindung mit Ferricyankalium aus dem Niederschlag mit Chloroform extrahirt. Es krystallisirt in goldgelben Nadeln, welche bei etwa 212° schmelzen.

Indigblau wird aus dem Dinitrodiphenyldiacetylen durch Ueberführung desselben in das Diisatogen erhalten. Zu diesem Zweck wird Dinitrodiphenyldiacetylen in fein zerteiltem Zustande mit concentrirter Schwefelsäure zu einem Brei angerührt und unter Abkühlung mit so viel rauchender Schwefelsäure versetzt, bis alles gelöst ist. Die dunkle kirschrote Flüssigkeit wird filtrirt und in kaltes Wasser oder Alkohol gegossen. In ersterem Fall scheidet sich das Diisatogen als dunkelroter amorpher Niederschlag aus, in letzterem in dunkelroten Nadeln.

Das Diisatogen liefert bei der Behandlung mit concentrirter Schwefelsäure und Eisenvitriol Indoin, mit verschiedenen anderen Reductionsmitteln dagegen Indigblau. Schwefelammon und Schwefelalkalien führen diese Substanz schon bei gewöhnlicher Temperatur in Indigo über, ebenso Zinkstaub in Verbindung mit Essigsäure, Ammoniak oder Natronlauge, ferner Traubenzucker in Verbindung mit Alkalien bei gelindem Ermärmen.

Ein zweites Verfahren zur Darstellung des künstlichen Indigos beruht auf der Umwandlung des Isatogens oder des Diisatogens in Verbindungen mit schwefliger Säure. Zur Darstellung der Isatogenverbindung wird Orthonitrophenylpropiolsäure oder Orthonithrophenylacetylen mit einer überschüssigen concentrirten Lösung von Ammoniumbisulfit gekocht, bis die genannte Säure vollständig verschwunden ist. Zur Entfernung der schwefligen Säure wird essigsaurer Baryt hinzugefügt, bis die Flüssigkeit nicht mehr getrübt wird, und filtrirt. Die so erhaltene gelbe Flüssigkeit liefert, mit Reductionsmitteln, z. B. Zinkstaub mit Ammoniak behandelt, Indigblau.

Zur Darstellung der Schwefligsäureverbindung des Diisatogens wird dieses mit überschüssigem Ammoniumbisulfit gekocht u. s. w. Die auf diesem Wege dargestellte Verbindung liefert ebenfalls bei der Behandlung mit Zinkstaub und Ammoniak oder anderen Reductionsmitteln Indigblau.

Im D. P. 19768 vom 24. Februar 1882 giebt die Badische Anilin-

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und Sodafabrik in Ludwigshafen a. Rh. ein Verfahren zur Darstellung des künstlichen Indigos aus dem Orthonitrobenzaldehyd an.

Durch Condensation des Orthonitrobenzaldehyds mit Brenztraubensäure in Gegenwart nicht alkalischer Condensationsmittel entsteht Orthonitrocinnamylameisensäure. Durch Einwirkung von Alkalien geht diese leicht in Indigblau über. Bewirkt man die Condensation des Orthonitrobenzahldehyds mit der Brenztraubensäure in Gegenwart von Alkalien, so entsteht direct Indigblau. In ähnlicher Weise erfolgt die Umwandlung von Orthonitrobenzaldehyd in Indigblau durch Aceton oder Acetaldehyd in Gegenwart von Alkalien. — Die Theorie gestattet die Annahme, dass, ganz allgemein, gemischte Ketone, welche Methyl in Verbindung mit Carbonyl enthalten, dieselbe charakteristische Reaction des Orthonitrobenzaldehyds eintreten lassen

Darstellung der Orthonitrocinnamylameisensäure. 10 Gewichtsteile Orthonitrobenzaldehyd werden in 6 Gewichtsteilen Brenztraubensäure unter gelindem Erwärmen gelöst und nach dem Erkalten auf 10° mit Salzsäuregas gesättigt. Nach zwei- bis dreitägigem Stehen wird die krystallinisch erstarrte Masse mit Wasser gewaschen und, wenn erforderlich, getrocknet und durch Umkrystallisiren aus Benzol vollends gereinigt.

$$\underset{\text{Orthonitrobenzaldehyd}}{C^6H^4(NO^2)\,COH} + \underset{\text{Brenztraubensäure}}{CH^3 - CO - COOH} =$$

$$\underset{\text{Orthonitrocinnamylameisensäure}}{C^6H^4(NO^2)\,CH = CH - CO - COOH} + H^2O.$$

Darstellung von Indigblau. 1. Die Orthonitrocinnamylameisensäure wird in eine gesättigte Lösung der doppelten Gewichtsmenge kohlensauren Natrons eingetragen und 24 Stunden bei gewöhnlicher Temperatur sich selbst überlassen. Das reichlich ausgeschiedene Indigblau wird filtrirt und mit Wasser gewaschen. — Dieselbe Umwandlung wird durch verdünnte kaustische Alkalien und alkalische Erden bewirkt. Erwärmen beschleunigt den Eintritt der Reaction. Durch passende Modification dieses Verfahrens lässt sich der künstliche Indigo auch auf der Faser erzeugen.

2. 10 Gewichtsteile Orthonitrobenzaldehyd werden mit 6 Gewichtsteilen Brenztraubensäure gemischt und allmälig mit einer zweiprocentigen wässerigen Natronlauge bis zur stark alkalischen Reaction versetzt. Nach zwei- bis dreitägigem Stehen wir das ausgeschiedene Indigblau filtrirt und mit Wasser gewaschen.

3. 10 Gewichtsteile Orthonitrobenzaldehyd werden in 15 Gewichtsteilen Aceton gelöst und nach und nach mit einer Lösung von 3 Gewichtsteilen Natronhydrat in 130 Teilen Wasser vermischt. Die schnell und ohne äusseres Ermärmen eintretende Abscheidung von Indigblau ist in zwei bis drei Tagen beendigt.

4. In derselben Weise verläuft die Darstellung des künstlichen Indigos aus dem Orthonitrobenzaldehyd unter Anwendung von Acetaldehyd an Stelle des Acetons.

Die Farbwerke vorm. Meister, Lucius & Brüning in Höchst a. M.

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gehen zur Darstellung des künstlichen Indigos vom Monobenzylidenaceton aus. Dasselbe lässt sich am einfachsten nach der Methode von Schmidt-Claisen (Ber. chem. Ges. 1881, S. 2472) aus Benzaldehyd und Aceton durch sehr verdünnte Natronlauge darstellen. Das Monobenzylidenaceton wird in das Orthonitrosubstitutionsproduct übergeführt und dieses durch Behandlung mit Alkalien in eine Substanz, die durch die Einwirkung von Wärme oder von anderen weiter unten beschriebenen Mitteln der Umwandlung in Indigo fähig ist. Die Nitrirung des Monobenzylidenacetons kann nach verschiedenen Methoden ausgeführt werden. Z. B. ein Teil Monobenzylidenaceton wird mit der fünffachen Menge Schwefelsäure zusammengerieben; in diese Mischung lässt man bei 0 bis 15° die berechnete Menge Salpetersäure vom specifischen Gewicht 1·46, welche in der doppelten Gewichtsmenge Schwefelsäure aufgelöst ist, langsam einfliessen. Nachdem diese Operation vollendet ist, scheidet man die in der Schwefelsäure gelöst bleibenden Nitroverbindungen durch Eingiessen dieser Lösung in viel Wasser ab, sammelt sie auf einem Filter, wäscht sie mit Wasser sorgfältig aus und löst sie in der $1^1/_2$fachen Menge Alkohol. Aus dieser Lösung hat sich nach mehrstündigem Stehen das Paranitromonobenzylidenaceton fast vollständig ausgeschieden. In der Mutterlauge ist das Orthonitromonobenzylidenaceton enthalten, welches man entweder durch Abdestilliren des Alkohols oder durch Versetzen der Mutterlauge mit dem 3 bis 4fachen Volumen Wasser gewinnen kann. Wird das Orthonitrobenzylidenaceton mit alkoholischer Natronlauge (beispielsweise 1 Teil des Ketons, 5 Teilen Alkohol und 3 Teilen einer 10procentigen Natronlauge) in der Kälte einige Zeit in Berührung gelassen, so ist es in eine neue Substanz verwandelt worden, die nach dem Ansäuern der Flüssigkeit derselben durch Ausschütteln mit Aether entzogen werden kann. Sie liefert beim Erwärmen ihrer wässerigen Lösung, noch leichter durch Zusatz von alkalischen Mitteln, wie Soda oder Aetznatron, zu derselben, in reichlicher Menge Indigo, welcher nach dem Auswaschen mit Wasser und Alkohol sofort rein ist. (D. P. 20255 vom 24. März 1882.)

Die Badische Anilin- und Sodafabrik in Ludwigshafen stellt ferner künstlichen Indigo aus den Orthoamidoderivaten des Acetophenons und des Phenylacetylens her. (D. P. 21592 vom 12. August 1882.) Hier sind nicht Nitroderivate (der Zimmtsäure und des Benzaldehyds) der Ausgangspunkt zur Synthese, sondern Amidoverbindungen, nämlich das Orthoamidoacetophenon und das Orthoamidophenylacetylen. Diese lassen sich durch successive oder auch gleichzeitige Behandlung mit Brom und Schwefelsäure in farblose Zwischenproducte überführen, welche durch Einwirkung von Alkalien und darauf folgende Oxydation Indigblau liefern. Durch Anwendung von Substitutionsproducten der genannten Amidoverbindungen lassen sich natürlich substituirte Indigblaus herstellen. — Das specielle Verfahren wird folgendermaassen beschrieben: Zu einer concentrirten Lösung von Acetylorthoamidoacetophenon oder von Acetylorthoamidophenylacetylen in Schwefelkohlenstoff wird eine gleiche Gewichtsmenge trockenen Broms langsam

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und unter Vermeidung von Erwärmung hinzugefügt. Während der Operation scheidet sich eine krystallinische Bromverbindung ab, deren Menge beim Stehen zunimmt. Dieselbe wird vom Lösungsmittel getrennt und in die 10 bis 20fache Gewichtsmenge concentrirter Schwefelsäure unter Abkühlung und beständigem Umrühren eingetragen. Wenn die nach kurzer Zeit eintretende lebhafte Entwickelung von Bromwasserstoff nachgelassen hat, wird die Lösung mit kaltem Wasser verdünnt und das sich in farblosen Flocken abscheidende Umwandlungsproduct von der sauren Flüssigkeit getrennt. Zur Ueberführung dieses Zwischenproductes in Indigoblau wird dasselbe mit einem geringen und bleibenden Ueberschuss verdünnter Natronlauge bei ungefähr 50 bis 60° so lange digerirt, bis eine klare, tiefgelbe Lösung entstanden ist, aus welcher sodann bei Berührung mit Luft sich reichlich Indigo abscheidet. Dies Verfahren lässt sich insofern abändern, als die Bromirung auch ohne Anwendung von Schwefelkohlenstoff oder anderer Lösungsmittel ausführbar ist, indem man das fein gepulverte, trockene Acetylderivat so lange in der Kälte einer Bromatmosphäre aussetzt, bis sich dasselbe unter Aufnahme einer ungefähr gleichen Gewichtsmenge Brom in ein tief rothgelbes Pulver umgewandelt hat. Ferner wirkt auch Salzsäure in einer ähnlichen aber unvollkommeneren Weise Schwefelsäure auf die Bromverbindung ein. Die getrennte Einwirkung des Broms und der Schwefelsäure kann auch zu einer Operation vereinigt werden, indem man die Amidoverbindungen oder deren Acetylderivate in Schwefelsäure löst, dann das Brom langsam zusetzt und im übrigen verfährt wie vorstehend angegeben. Die Einwirkung der ätzenden Alkalien vollzieht sich bereits in der Kälte bei längerem Stehen; auch alkalische Erden und kohlensaure Alkalien bewirken in der Wärme die Indigobildung.

Die Darstellung von Orthonitrometamethylbenzaldehyd aus dem Metamethylbenzaldehyd und die Herstellung eines homologen Indigotins aus jenem wird von dem Farbwerk vorm. Meister, Lucius & Brüning in Höchst a. M. im D. P. 21683 vom 2. Juli 1882 beschrieben. Der aus Metaxylol erhaltene Toluylaldehyd verhält sich beim Nitriren wie die Metabrombenzoesäure, d. h. die Nitrogruppe nimmt in Bezug auf die CHO-Gruppe die Orthostellung ein. Der so erhaltene Metamethylorthonitrobenzaldehyd kann nach dem D. P. 19768 der Badischen Anilin- und Sodafabrik (vgl. S. 492) leicht in Methylindigo übergeführt werden. Der Toluybaldehyd wird in conc. Schwefelsäure gelöst und mit einem Gemisch von Salpetersäure und conc. Schwefelsäure nitrirt. Der Nitroaldehyd ist ölförmig, von gelblicher Farbe, schwer löslich in Wasser, leicht in Alkohol, Benzol, Aether und Aceton, mit Wasserdämpfen flüchtig.

Als Beispiel für die Darstellung von Methylindigo wird folgendes Verfahren angegeben: Die Lösung von 1 Tl. Metamethylorthonitrobenzaldehyd in der doppelten Menge Aceton wird mit 25 Tln. einer 2proc. Natronlauge versetzt. Der Indigo, dessen Bildung in kurzer Zeit erfolgt, wird auf einem Filter gesammelt und zur Reinigung mit Wasser, später mit Alkohol ausge-

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waschen. An Stelle des Acetons können auch Aldehyd und Brenztraubensäure verwendet werden. (D. P. 19768 der Badischen Anilin- und Sodafabrik.)

In seinen physikalischen Eigenschaften gleicht der Methylindigo dem natürlichen Indigo sehr; er ist von dunkelblauer Farbe und zeigt nach dem Reiben Kupferglanz; zum Unterschied vom Indigo zeigt er eine bemerkenswerte Löslichkeit in Alkohol. Salpetersäure löst ihn beim Erwärmen unter Zerstörung mit gelber Farbe.

Bei der Nitrirung des Metaoxybenzaldehyds entstehen neben der Paranitroverbindung, die zum Vanillin führt, wie dies im D. P. 18016 der Farbwerke vorm. Meister, Lucius & Brüning beschrieben ist*) auch Orthonitrometaoxybenzaldehyde. Letztere, sowie die entsprechenden Methoxylverbindungen können nach dem D. P. 20116 vom 26. Februar 1882 von Meister, Lucius & Brüning zur Darstellung von Farbstoffen dienen. Das Nitrirungsproduct des Metaoxybenzaldehyds wird in kochendem Wasser gelöst. Beim Erkalten auf 50 bis 60° scheiden sich gelbe Blättchen von α-Orthonitrometaoxybenzaldehyd (Schmelzp. 128°) aus; bei weiterer Abkühlung ein Gemisch des bei 161° schmelzenden in langen Nadeln krystallisirenden isomeren β-Orthonitrometaoxybenzaldehyds mit der Paranitroverbindung (Schmelzp. 138°). Durch wiederholtes Umkrystallisiren aus Wasser kann man beide Verbindungen von einander trennen.

Beim Nitriren des Metamethoxylbenzaldehyds entstehen drei isomere Mononitrokörper. Aus Chloroform oder Benzol erhält man durch fractionirte Krystallisation α-Orthonitrometamethoxylbenzaldehyd (grosse Prismen vom Schmelzp. 107°), die β-Orthonitroverbindung (Nadeln vom Schmelzp. 82 bis 83°) und die Paranitroverbindung (Nadelgruppen vom Schmelzp. 98°).

7. Pyridin- und Chinolin-Farbstoffe.

Die Pyridin- und Chinolinbasen treten mehr und mehr in den Kreis der Rohstoffe für die Teerfarbenfabrikation. Von mehreren Seiten ist neuerdings die genaue Erforschung dieser Körpergruppe in Angriff genommen. Döbner und v. Miller haben durch Einwirkung von Aethylenalkohol oder Aldehyd auf ein Gemisch von Nitrobenzol, Anilin und concentrirter Schwefelsäure eine dem Chinolin homologe Base $C^{10}H^9N$ das „Chinaldin“ dargestellt, welche gut krystallisirende Salze liefert. Beim Kochen von Chinaldin mit Salpetersäure entsteht Nitrochinolincarbonsäure $C^9H^5N(NO^2)\cdot COOH$, farblose Krystalle vom Schmelzpunkt 219—220°, schwer löslich in kaltem, leicht in heissem Wasser. Anders verläuft die Oxydation des Chinaldin durch Kaliumpermanganat. Dabei entsteht als Hauptproduct Acetylanthranilsäure $C^6H^4<\begin{matrix}NH\cdot C^2H^3O\\COOH\end{matrix}$ (Schmelzpunkt 184°), ausserdem Oxalsäure und Anthranilsäure. Aus diesem Verhalten folgern D. und M., dass Chinaldin ein Methylchinolin $C^6H^4<\begin{matrix}N:CH^3\\|\\CH:CH\end{matrix}$ sei. (Ber. chem. Ges. 15, 3075.)

*) Techn.-chem. Jahrb. 1883, S. 350.

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Ein phenylirtes Chinolin, $C^6H^4<\begin{matrix}N:C\cdot C^6H^5\\ |\\ CH:CH\end{matrix}$ haben Döbner und Miller ebenfalls dargestellt. Während Anilin und Zimtaldehyd sich leicht zu Zimtanilid $C^6H^5N\cdot C^9H^8$ (Schmelzpunkt 109°) verbinden, ist die Reaction beim Kochen dieser Körper mit concentrirter Salzsäure eine andere: es bildet sich ein rötliches Harz, aus welchem Natronlauge eine über 300° destillirende Base, das Phenylchinolin, abscheidet. Dieser Körper krystallisirt aus Alkohol in Nadeln vom Schmelzpunkt 83°. Die Salze sind gut krystallisirt. Die Base ist identisch mit der von Grimaux (Compt. rend. 96, 584) aus Zimtaldehyd, Anilin, Nitrobenzol und concentrirter Schwefelsäure erhalten.

Ueber eine Darstellungsmethode im Pyridinkern substituirter Chinolinderivate. Von P. Friedländer und C. F. Gohring. Orthoamidobenzaldehyd verbindet sich mit Aldehyden und Ketonen in Gegenwart verdünnter Natronlauge allgemein zu substituirten Chinolinen, entsprechend dem Schema:

$$C^6H^4\begin{matrix}CHO\\ NH^2\end{matrix} + \begin{matrix}CH^2(x)\\ |\\ CO\ (y)\end{matrix} = C^6H^4\begin{matrix}CH=C(x)\\ |\\ N=C(y)\end{matrix} + 2H^2O.$$

Acetylaldehyd und Orthoamidobenzaldehyd liefern Chinolin selbst:

$$C^6H^4\begin{matrix}CH=CH\\ |\\ N=CH.\end{matrix}$$

Wässerige Lösungen von *o*-Amidobenzaldehyd und einem Aceton vereinigen sich auf Zusatz von wenig Natronlauge in der Kälte zu *α*-Methylchinolin oder Chinaldin; *o*-Amidobenzaldehyd und Acetophenon in verdünntem Alkohol gelöst und mit einigen Tropfen Natronlauge kurze Zeit erwärmt, liefern *α*-Phenylchinolin. Ein *β*-Phenylchinolin, welches der *α*-Verbindung isomer ist, entsteht durch Vereinigung von Phenylessigsäurealdehyd $C^6H^5.CH^2.CHO$ mit *o*-Amidobenzaldehyd in alkoholischer Lösung unter Mitwirkung von Natronlauge, das *β*-Phenylchinolin ist ein farbloses, bei niedriger Temperatur erstarrendes Oel, sein salzsaures Salz bildet feine weisse Nadeln.

o-Amidobenzaldehyd liefert mit einer alkalischen Lösung von Acetessigäther schon in der Kälte eine in weissen Nadeln vom Schmelzpunkt 71° krystallisirende Verbindung. Dieselbe ist der Aethyläther einer Lepidincarbonsäure $C^6H^4\begin{matrix}CH=C-COOC^2H^5\\ |\\ N=N\cdot CH^3\end{matrix}$. Die aus dem Aether durch Erhitzen mit alkoholischer Natronlauge oder mit concentrirter Salzsäure abgeschiedene Lepidincarbonsäure ist schwer löslich, krystallisirt aus viel Alkohol in farblosen Nadeln vom Schmelzpunkt 234°; beim Schmelzen zersetzt sie sich in Kohlensäure und *α*-Lepidin.

Eine andere Reaction tritt ein, wenn *o*-Amidobenzaldehyd und Acetessigäther ohne Lösungsmittel auf etwa 160° erhitzt werden; es entsteht dann ein bei 232° schmelzendes, in weissen Nadeln krystallisirendes Product $C^{11}H^9NO^2$, welches der Lepidincarbonsäure isomer, aber von ihr durchaus verschieden ist.

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Benzoylacetessigäther, in der Kälte auf *o*-Amidobenzaldehyd wirkend, wird zerlegt in Kohlensäure und Acetophenon, welches letztere sich mit dem *o*-Amidobenzaldehyd zu *α*-Phenylchinolin condensirt. Ein anderes Product resultirt, wenn beide Substanzen zusammen erhitzt werden. (Ber. chem. Ges. 16, 1883; Chem. Ind. 1883, S. 226.)

Emil Jacobsen in Berlin. Verfahren zur Darstellung von roten und violetten Farbstoffen durch Einwirkung von Benzotrichlorid auf Pyridin- und Chinolinbasen. (D. P. 19306 vom 14. Februar 1882.) Wenn gleiche Volumina Benzotrichlorid und Chinolin bei 130° längere Zeit erwärmt werden, so bildet sich eine rotgefärbte dickflüssige Masse, aus welcher nach Entfernung überschüssiger Base durch kaltes Wasser mit siedendem Wasser die Farbbase extrahirt wird. Diese wird durch Lösen in Säure und Wiederfällen gereinigt. Dieselbe ist unlöslich in Aether und Ligroin, fast unlöslich in Wasser, leicht löslich in Alkohol und Eisessig; die Salze sind schwer in Wasser, leicht in Alkohol. Die Lösungen der Base und der Salze sind violetrot mit stark rotgelber Fluorescenz, welche auch auf der damit gefärbten Wolle und Seide sichtbar ist. Mit Tannin gebeizte Baumwolle wird leicht gefärbt, und der Farbstoff widersteht stark alkalischen Bädern. Die Homologen der Chinolins, sowie die Pyridinbasen reagiren wie das Chinolin. Die Farbstoffe aus den Pyridinbasen sind weniger schön, als die aus den Chinolinbasen, besitzen aber grosse Färbekraft.

E. Jacobsen in Berlin. Darstellung gelber Farbstoffe aus Pyridin- und Chinolinbasen. (D. P. 23188 vom 4. November 1882.) Die genannten Basen, sowie auch das Chinaldin und analoge Stoffe bilden beim Erhitzen mit Phtalsäureanhydrid und Chlorzink gelb färbende Condensationsproducte, die durch Ueberführung in die Sulfosäure wasserlöslich werden. Die Phtalsäure kann auch durch Nitrophtalsäure, sowie durch Phtalimid ersetzt werden. Man erhitzt 1 Mol. Phtalsäureanhydrid mit 2 Mol. der Basis und 1 Mol. Chlorzink bei 200°; bei Chinaldin und dessen Homologen ist Erhitzung bis auf 250° erforderlich. Die in Wasser unlöslichen Farbstoffe werden durch Umkrystallisiren aus Eisessig gereinigt.

Farbwerke, vorm. Meister, Lucius & Brüning in Höchst a. M. geben ein Verfahren zur Darstellung von Methylchinolin aus Orthonitrobenzylidenaceton an. (D. P. 22138 vom 25. Juli 1882.) Das aus Benzylidenaceton durch Nitriren etc. gewonnene Orthonitrobenzylidenaceton geht bei der Behandlung mit reducirenden Mitteln in Methylchinolin über.

$$C^6H^4\overset{NO^2.}{\underset{CH.CH.CO\,CH^3}{}} + 3H^2 = C^6H^4C^3H^2(CH^3)N + 3H^2O.$$

Zur Reduction des Orthonitrobenzylidenacetons eignet sich Zinnchlorür und Salzsäure am besten; auf 20 Teile Orthonitrobenzylidenaceton gebraucht man 75 Teile Zinnchlorür und 75 Teile Salzsäure (spec. Gew. 1·2), welche mit derselben Menge Wasser verdünnt ist. Die Bildung des Methylchinolins vollzieht sich unter starker Wärmeentwickelung. Die Reactionsmasse versetzt man mit Kalkhydrat im Ueberschuss und destillirt die neue Base im Wasser-

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dampfstrome ab. Das Methylchinolin, welches zur Darstellung von Azofarbstoffen verwendet werden kann, siedet bei ca. 240° und liefert schön krystallisirende Salze.

Otto Fischer in München. Verfahren zur Herstellung der methylirten und äthylirten Abkömmlinge der Oxychinolintetrahydrürs, Methoxychinolintetrahydrürs und Aethoxychinolintetrahydrürs. (D. P. 21150 vom 1. März 1882. Die aus Chinolinsulfosäure dargestellten Verbindungen, Oxychinolin und Methoxychinolin, lassen sich, wie O. Fischer und Bedall nachgewiesen haben,*) durch Reductionsmittel in Tetrahydroverbindungen überführen. Das Oxychinolin sowol, wie die Hydrüre geben in Combination mit Basen Azofarbststoffe. Die Tetrahydrüre können durch Einwirkung von Jodalkylen in Methyl- und Aethylderivate etc. übergeführt werden, welche tertäre Basen sind: $C^9H^{11}NO + CH^3J = HJ + C^{10}H^{13}NO$.

Oxychinolintetrahydrür.

Das α-Oxyhydromethylchinolin krystallisirt in Tafeln oder in Prismen vom Schmelzpunkt 114°. Die Salze sind meist löslich und geben mit Natriumnitrit eine rotgelbe, durch Einwirkung gelinder Oxydationsmittel eine blaurote Färbung. Sie besitzen einen salzigen, nachher bitteren Geschmack. Die Salze des α-Oxyhydroaethylchinolins sind noch leichter löslich als die der vorigen Base. Das α-Methoxyhydromethylchinolin ist ein dickes hellgelbes Oel, welches leicht lösliche Salze bildet. Das β-Oxyhydromethylchinolin krystallisirt, schmilzt nicht ohne Zersetzung und bildet leicht lösliche Salze. Diese Körper geben mit Diazosalzen gelbrote und braune Farbstoffe. Wichtiger aber ist der Umstand, dass dieselben hervorragend antipyretische Eigenschaften besitzen und das Chinin völlig zu ersetzen vermögen.

O. Fischer macht noch folgende nähere Angaben. Beim Erhitzen des Chinolins mit Schwefelsäure entstehen eine α- und eine β-Sulfosäure, welche mit Kalihydrat zusammengeschmolzen α-Oxychinolin resp. β-Oxychinolin liefern. Das α-Oxychinolin ist identisch mit dem von Skraup beschriebenen Orthooxychinolin, die β-Verbindung ist identisch mit dem Metaoxychinolin Skraup's. α-Oxychinolin $(OH)C^9H^6N$ (Schmelzpunkt 75—76°), wird durch Behandeln mit Zinn und Salzsäure in α-Oxychinolintetrahydrür $(OH)C^9H^{10}N$ übergeführt. Das Zink- und Zinndoppelsalz des letzteren sind in conc. Salzsäure schwer löslich. Das α-Oxyhydrochinolin ist eine secundäre Base und wird durch Behandeln mit Jodmethyl in eine tertiäre Methylbase das α-Oxyhydromethylchinolin $(OH)C^9H^9N(CH^3)$ verwandelt. Letzteres krystallisirt aus Aether in rhombischen Tafeln, schmilzt bei 114°, löst sich in kaustischen Alkalien, ist in Wasser schwer, in Benzol und heissem Alkohol leicht löslich. Das salzsaure Oxyhydromethylchinolin ist in Wasser leicht löslich und bildet monokline Krystalle. Das Salz wirkt als fiebervertreibendes Mittel und ist unter dem Namen „Kairin" bekannt. Das schwefelsaure Salz der methylirten Hydrobase bildet sehr leicht lösliche Prismen, das Pikrat gelb-

*) Vgl. Ber. chem. Ges. 15, S. 1366 und 2570.

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grüne, kleine Tafeln, im Wasser schwer löslich. Durch Einwirkung von Jodäthyl auf α-Oxyhydrochinolin bei 50—60° oder von Bromäthyl bei 120° im Rohr wird das α-Oxyhydroäthylchinolin $OHC^9H^9N(C^2H^5)$ erhalten; dasselbe bildet weisse Tafeln vom Schmelzpunkt 76° und gleicht in seinem Verhalten der Methylverbindung. Das leicht lösliche salzsaure Salz (Kairin *A*) krystallisirt in weissen Prismen. α-Aethoxylchinolin $(C^2H^5O)C^9H^6N$ wird durch Kochen von 1 Mol. Oxychinolin mit 1 Mol. Aetzkali und der berechneten Menge Bromäthyl in alkoholischer Lösung dargestellt. Die Aethoxylbase siedet bei 285—287° (bei 718 mm Druck) und bildet ein dickes Oel, welches unter 0° erstarrt. Zinn und Salzsäure deduciren die Base zu Aethoxylhydrochinolin, welches bei 275—276° (716 mm Druck) siedet und durch salpetrige Säure in eine Nitrosoverbindung verwandelt wird. Durch Erwärmen der Hydrobase mit Jodmethyl bei 50—60° entsteht Aethoxyhydromethylchinolin, eine bei 269—270° siedende Flüssigkeit. Erwärmt man die Hydrobase (2 Mol.) mit Monochloressigsäure (1 Mol.) in wässiriger Lösung eine Stunde auf 100 bis 100°, so bildet sich ein als „Kairocoll" bezeichneter Körper $C^{11}H^{11}NO^2$, welcher lange, feine, bei 66° schmelzende Nadeln bildet. Die methylirten und äthylirten Oxyhydrochinoline äussern, wie das „Kairin", antipyretische Wirkungen auf den Organismus. (Ber. chem. Ges. Bd. 16, S. 712; Chem. Ind. 1883, S. 138.)

Statistik.

Im Deutschen Reich betrug, in metr. Centnern ausgedrückt, die

Waarengattung.	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an Teer	286 820	318 165	116 936	118 441
„ Anilin, Toluidin	2 882	3 082	7 141	6 615
„ Anilinfarben und anderen Teerfarbstoffen	5 716	5 295	31 141	32 465
„ Bleiweiss, Zinkoxyd (Zinkweiss)	25 999	27 572	132 770	146 736
„ Cochenille	1 938	2 085	553	597
„ Blauholz	354 509	387 226	68 535	69 405
„ Gelbholz	60 170	68 447	9 735	8 860
„ Rotholz	88 543	101 097	19 523	16 401
„ Indigo	15 616	16 488	5 209	5 472
„ Krapp, auch gemahlenem	6 548	5 633	3 208	2 989
„ Farbholzextracten	46 488	44 962	5 462	7 645

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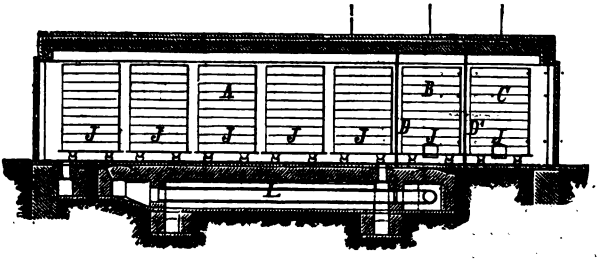
XXXIII. Gespinnstfasern.

E. Fremy und Victor Urbain in Paris haben ein Verfahren zur Herstellung farbloser Gespinnstfasern aus Pflanzen angegeben (D. P. 22370). Durch das Verfahren soll der die Fasern färbende Pflanzenleim beseitigt werden. Zu dem Zweck können die verschiedensten Oxydationsmittel verwendet werden, ferner löst der Leim sich in Alkalien und in Alkalicarbonaten, besonders bei Anwendung von Druck. Das Verfahren soll das Rösten des Flachses ersetzen. Zur Entfernung des Leims genügt, dass die Fasern einige Minuten mit concentrirtem Aetznatron gekocht werden; bei Anwendung von Alkalicarbonat ist längere Zeit (4 Stunden) und Temperatur von 130° nötig. Das Kochen mit Aetznatron ist zwar früher schon angewendet worden; um aber den Fasern eine weisse Farbe und seidenähnliche Beschaffenheit zu geben, war noch eine besondere Behandlung nötig (z. B. mit Kohlensäure und Glycerindämpfen; Bleichen mit Hypochloriten). Hier soll das längere Kochen mit Alkalicarbonaten, denen event. noch geringe Mengen Kalk zugesetzt werden, das gleiche Resultat ergeben.

Ekmann in Bergvik (D. P. 21943) kocht zur Herstellung von Einzelfasern von reiner Cellulose aus Flachsstengeln u. dgl. diese Pflanzen unter Druck mit Lösungen von Magnesium- oder Natriumsulfit, wobei die Basis im Ueberschuss vorhanden sein kann.

Fellner und Chr. Heinzerling in Frankfurt beschreiben im (D. P. 19067 einen Carbonisationsofen, der aus drei gemauerten Kammern *A B C* besteht, welche durch Schiebethüren *DD*$_1$ getrennt sind. *A* dient zum Trocknen, *B* zum eigentlichen Carbonisiren, *C* zum Entsäuren der gebeizten Stoffe. Diese drei Kammern bilden, nachdem die Schiebethüren *D* und *D*$_1$ aufgezogen sind, eine einzige langgestreckte Kammer, welche als Trockenapparat dienen kann. Die Kammern enthalten Wagen *J*, von welchen jeder eine Anzahl Hürden von Drahtgewebe trägt. Ausserhalb dieser drei Kammern ist eine Feuerung angebracht, deren Verbrennungsproducte einen Calorifers *L* und einen Säureentwickler heizen.

Fig. 286.



Krbusch und Emonds in Dolhain bei Verviers (D. P. 20028 vom 31. Dec. 1881) breiten den zu carbonisirenden Stoff in der innen mit Bleiplatten beegten Kammer *a* auf Hürden *b* aus, welche aus Glasstäben hergestellt sind,

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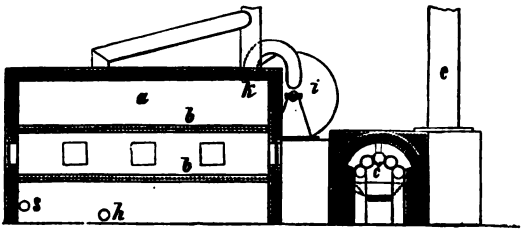
deren Enden in allseitig verbleiten Langhölzern stecken. In den halbkreisförmig angeordneten Röhren des Ofens *c*, von welchen zwei nach unten in den Aschenfall, die anderen vorn ins Freie münden wird heisse, rauchfreie Luft hergestellt, indem die Feuerluft auf ihrem Wege nach dem Kamin *e* die Luftröhren erst unten, dann oben der Länge nach bestreicht. Die Luft sammelt sich in einer am hinteren Ende des Ofens befindlichen Sammelkammer, welche noch teilweise von der Feuerluft bestrichen wird, und wird dann mittelst eines Ventilators durch die Oeffnung *h* in die Kammer *a* getrieben. Gleichzeitig saugt ein zweiter Ventilator *i* die heisse Luft bei *k* aus *a* heraus, so dass sie auf ihrem Wege durch die Hürden *b* den darauf liegenden Stoff trocknet. Durch die Umstellung verschiedener Klappen wird nun die Kammer *a* aus dem heissen Luftstrome ausgeschaltet und dieser durch einen kleinen Ofen geleitet, wo in einem kupfernen, inwendig verbleiten Kessel Salzsäure zum Sieden gebracht wird. Die Dämpfe der Säure werden durch den Ventilator *i* bei s in die Kammer *a* getrieben und bewirken die Verkohlung der Pflanzenfasern in den auf *b* liegenden Stoffen. Endlich wird der heisse Luftstrom wieder durch *a* geleitet, bis alle Säuredämpfe aus *a* entfernt sind.

Fig. 287.



P. Thomas in Elberfeld bleicht Gewebe ohne Chlor. (D. P. 20872) Das Object wird zunächst mit Aetznatron gekocht, hierauf 15—30 Minuten lang in ein concentrirtes, warmes Bad aus Kaliumpermanganat und schliesslich nach erfolgter Abkühlung in ein solches aus Borax und schwefliger Säure 15—30 Minuten eingeführt. Das letztere besteht aus 1000 g Borax in 100 l kaltem Wasser, welches mit schwefliger Säure gesättigt war, gelöst.

Kudelski in La Vendée hat auf die Darstellung von Sulfiten für Bleichzwecke das Engl. P. 3773 vom 8. August 1882 erhalten, nach welchem Kalkmilch mit schwefliger Säure gesättigt und die Lösung mit den Sulfaten der Alkalien oder des Magnesiums gefällt wird.

James Young in Kelly, Renfrew (Engl. P. 653 vom 10. Februar 1882) zersetzt Chlorkalklösung mit Alkali- oder Magnesiumsulfat.

E. und R. Jacobsen in Berlin wenden beim Bleichen vegetabilischer und animalischer Substanzen (D. P. 21081 vom 12. April 1882) an Stelle des sich leicht zersetzenden Wasserstoffsuperoxydes Gemenge von Bariumsuperoxyd mit Metallsalzlösungen an. Die günstigsten Resultate werden erhalten bei Anwendung von kieselsauren Alkalien, sowie von Chlorammonium, borsauren und fettsauren Alkalien, bezw. Gemischen derselben. Die Gewichtsverhältnisse einer gut wirkenden Mischung sind z. B. folgende: 1 Tl. trockenes Natronwasserglas, 1 Tl. Bariumsuperoxyd, 100 Tle. Wasser.

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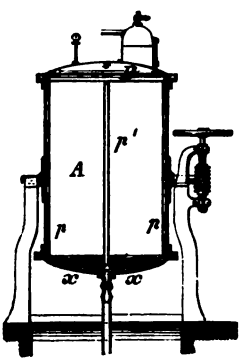
John Auchinvole in Glasgow und U. Pornitz in Chemnitz. Verfahren zum Bleichen, Färben und Trocknen von Cops, Garnen und Stückwaaren aus vegetabilischen Fasern im Vaccumapparat unter Benutzung von directem Dampf und heisser Luft. (D. P. 21388 vom 4. Juni 1882.) Die Behandlung der Stoffe findet in einem aus zwei verbundenen Gefässen bestehenden Vacuumapparat statt, in welchem die Einwirkung aller Flotten nach einander erfolgt, ohne dass das Material herausgenommen oder getrennt zu werden braucht.

Henry Anthoni in Paris bringt die Baumwolle zum Bleichen und Färben entweder als Rohmaterial oder auch schon in Vliess-, Band- oder Luntenform in cylindrische mit perforirten Wandungen, Boden und Deckel versehene Kannen oder Töpfe, welche in einem hermetisch verschliessbaren Kessel eingesetzt werden. Derselbe ist mit einem Dampfmantel und Heizschlange versehen. Durch ein Rohr lässt man, nachdem der Kessel verschlossen, die betreffende Wasch-, Bleich- oder Farbeflüssigkeit eintreten; dieselbe durchdringt die Gespinnstfaser in den Töpfen und wird nach gehöriger Einwirkung wieder abgelassen. (D. P. 21573.)

Gustav Jagenburg in Rydboholm. Schwarzfärben von loser Baumwolle. (D. P. 20691, Engl. P. 3553 vom 16. August 1881.) Die lose Baumwolle kommt zunächst in ein Blauholzbad, dem zur Erzeugung verschiedener Nüancen andere Farbstoffe, Quercitron, Catechu, Anilinfarben und dergl. zugesetzt werden können. Die Baumwolle wird alsdann getrocknet und gedämpft, worauf der Farbstoff in einem kalten Bade, bestehend aus einer Lösung von Eisen-, Kupfer-, Chrom-, Zink- oder Vanadiumsalzen entwickelt wird. — Das Färben sowohl, als auch die Entwickelung des Farbstoffes geschieht in einem drehbaren Imprägnirkessel A, in welchem perforirte Verteilungsröhren p und p' angebracht sind, die mit in dem Boden befindlichen Canälen x in Verbindung stehen. An Stelle der Verteilungsröhren kann auch eine doppelte Wandung treten und die innere in zweckmässiger Weise durchlöchert werden. Der Kessel besitzt einen abnehmbaren Deckel B oder ein Mannloch, ferner einen Siebboden, welcher verhindert, dass beim Ablassen der Flüssigkeit die Baumwolle hinabfliesst. Um den Kessel mit der betreffenden Flüssigkeit zu füllen, wird derselbe nach dem Beschicken mit Baumwolle evacuirt, worauf die Flüssigkeit von unten her aus einem Reservoir in den Kessel steigt.

Fig. 288.



Um Webstoffe scharlach zu färben, bringt Dan. Dawson in Huddersfield (Engl. P. 1280 vom 17. März 1882) dieselben in ein Bad, welches die Lösung eines Rosanilinsalzes, Natriumnitrit und Salzsäure enthält, sodann in eine alkalische Lösung von β-Naphtol.

Ch. Holliday in Huddersfield, York. Erzeugung von Azofarben

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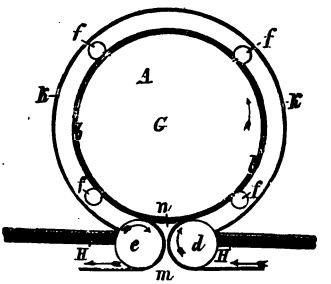
auf der Baumwollfaser (Engl. P. 2946 vom 21. Juni 1882). Der Baumwollstoff wird erst mit Oel gebeizt, wie es in der Türkischrotfärberei gebräuchlich ist. Nach dem Waschen und Trocknen kommt derselbe in eine schwache wässrige Naphtollösung und dann in die Lösung eines Diazo- oder Amidoazokörpers. Die leicht saure Lösung wird vor dem Gebrauch mit dem Carbonat einer alkalischen Erde neutralisirt.

Justus Wolff in Mannheim. Verfahren und Apparat zum Steifen oder Animalisiren vegetabilischer Gewebe durch belichteten Chromleim. (D. P. 18640.) Das Gewebe wird auf einer Seite mit einer Schicht Chromleim überzogen und darauf teilweise der Wirkung der aktinischen Lichtstrahlen ausgesetzt. Es ist hierdurch ermöglicht, den Stoff wie Wolle mit Wollfarbstoffen zu färben und farbige Drucke durch totales oder stellenweises Animalisiren und Belichten der Faser herzustellen. Durch späteres Auswaschen wird der nicht vom Licht getroffene und löslich gebliebene Chromleim entfernt.

Der Apparat, dessen man sich zur Belichtung des mit Chromleim imprägnirten Gewebes bedient, besteht aus dem Glascylinder *A*. Auf der Aussenseite der Wandung *b* sind die transparenten Negative oder offenen Muster befestigt (mit der Bildseite nach aussen). Der Glascylinder läuft auf acht Leitrollen *f*, von denen sich vier an jedem Ende des Cylinders befinden. Im Centrum *G* des Cylinders *A* befindet sich die Quelle der aktinischen Stralen, welche überall gleichmässig durch die Cylinderwandung *b* und durch die darauf befestigten Transparente oder Muster auf das mit der lichtempfindlichen Masse getränkte oder bedruckte Material wirkt, das über die Walze *d* aus dem lichtfreien Raum *m* über den sich mit gleichmässiger Geschwindigkeit bewegenden Cylinder *A* geht und über die Walze *e* in den Raum *m* wieder eintritt. *n* ist ein Schild, das den Eintritt aktinischen Lichtes in den Raum *m* verhindert, zu welchem Zweck auch die Wände *HH* dienen. Zu gleicher Zeit mit dem präparirten Material, und zwar auf dessen Rückseite, geht ein undurchsichtiges, dünnes Material über den Cylinder, welches die Durchstralung des aktinischen Lichtes in den Raum zwischen der Cylinderwandung und dem Blechmantel *k* verhindert.

Fig. 289.



Paul St. Ange Basquin in Church, England. Apparat und Verfahren zum Bleichen von aufgeklotzten, gefärbten oder gedruckten Geweben oder Faserstoffen und zur Gewinnung von Essigsäure etc. aus denselben. (D. P. 21137.)

Oscar Diehl in Warnsdorf in Böhmen. Dämpfapparat zur Neutralisirung und Fixirung von Druckfarben auf baumwollenen Stoffen oder Garnen mit Ammoniakgas. (D. P. 21077.)

Indigo-Druckverfahren von Julius Ribbert in Hohenlimburg. (D. P.

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20586.) Der mit Aetznatronlauge eingeweichte, dann gemahlene Indigo wird mit Wasser und Dextrin zu einem Brei verarbeitet, dem man unter Abkühlung trockenes Aetznatron zufügt, wobei die Temperatur nicht über 25° R. steigen darf. Mit Traubenzucker imprägnirtes Zeug wird mit der verdickten Masse bedruckt, getrocknet und in einem continuirlichen Dampfapparat etwa 5 Minuten gedämpft, wobei der Indigo reducirt wird. In der direct darauf folgenden Wasserpassage wird der Indigo 30 Minuten lang oxydirt und das Zeug getrocknet. Man braucht auf 2000 g Indigo, 4400 g Aetznatron, 500 g Dextrin, 6800 g Wasser, 26 g Präparation des Zeuges.

Herstellung von Farben zum Bedrucken von Textilstoffen etc. Von Peter Reid in Passaic und John Eastwood in Belleville, V. St. A. (D. P. 22112.) Um die Farben besser zu fixiren, wird den betreffenden Farbstoffen eine Lösung von Pyroxylin und Campher in Alkohol, Holznaphta oder dergleichen zugesetzt. Eine solche Farbe besitzt eine passende Consistenz und kann in gebräuchlicher Weise auf Walzen, Typen und anderen Instrumenten zur Herstellung eines Druckes auf Textilstoffe, Leder, Papier etc. Anwendung finden.

Fred. Will. Cottrell in London stellt künstliches Elfenbein her aus nitrirter Pflanzenfaser. Die Säure wird nach dem Nitriren nicht vollständig ausgewaschen. Darauf wird die Masse mit einer concentrirten Lösung von Bariumsulfid behandelt. Dabei sollen noch concentrirte Lösungen von Alaun, Soda und Wasserglas zugesetzt werden. (Engl. P. 220 vom 16. Januar 1882.)

XXXIV. Papier.

Geschichte und Allgemeines. Die Papierindustrie in neuester Zeit. Carl Hoffmann. (Pap.-Ztg. 684, 742.)

Zur Geschichte des Lumpenpapiers (Pap.-Ztg. 1882, S. 772) und Briquet (das. S. 918).

Ueber die Elasticität des Papieres. Hartig. (Pap.-Ztg. 1882, S. 598.

Hoyer giebt in einer Brochüre: Das Papier, seine Beschaffenheit und Prüfung, München, 1882, S. 54, (auch in Pap.-Ztg. wiedergegeben) nähere Angaben über Beschaffenheit und Prüfung des Papiers. Er kommt u. a. zu dem Resultat, dass Maschinenpapier und Handpapier derselben Zusammensetzung nahezu dieselbe Festigkeit haben, dass jedoch die Bruchdehnung des letzteren an 4mal grösser, also das auf Maschinen getrocknete Papier um so viel spröder als an der Luft getrocknetes ist, was auf die zu schnelle Trocknung des ersteren zurückzuführen ist. Zur Bestimmung von Bruchdehnung, d. i. Dehnung vor dem Zerreissen, und Festigkeit eignen sich in der Diagonale der Bogen geschnittene Streifen, weil solche ziemlich das Mittel aus den mit Längs- und Querstreifen erhaltenen Werten geben. Der Wert der Festigkeit wird nach Hartig in Reisslängen angegeben, d. i. die Länge des frei herabhängenden Papieres, bei welcher es durch eigenes Ge-

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wicht abreisst. Es werden so für die höheren Papiergattungen (Hand- oder Maschinenpapier) folgende Normalien aufgestellt:

Papiersorte.	Aschengehalt in Proc.	Bruchdehnung in Proc.	Gewicht pr. Qm in Gramm	Reisslänge in Meter
1. Urkunden- und Bücherpapier, animalisch geleimt	1·0	4·0	100	5000
2. Dasselbe mit Harzleimung	2·0	3·5	100	4500
3. Kanzlei-, Brief-, Mundirpapier	2·0	3·0	90	4000
4. Conceptpapier	2·0	2·5	70	3000
5. Druckpapier, geleimt	2·0	2·5	70	3000
6. Fliesspapier	0·4	1·5	60	1000

Eine Zerreissmaschine, Dasymeter, von R. Horack in Wiener-Neustadt, wird beschrieben, dann eine solche von Prof. Hartig bezw. Reusch, die von Oscar Leuner in Dresden zu beziehen ist (vgl. auch eine Abänderung letzterer Maschine D. P. 20382, Hoyer in München.)

Papier aus Esparto. Lunge giebt (Pap.-Ztg. 1882) Mitteilungen über die Verarbeitung des Esparto (Alfa) zur Papierfabrikation. Das spanische ist die beste Waare, schlechter ist solche aus Algier, noch schlechter die aus Tunis. Esparto besitzt eine ausgezeichnet lange und feste Faser, die es dazu befähigt, einem kurzen Stoff bedeutend grössere Festigkeit zu geben. Es wird mit Natron gekocht (Hochdruck ist nicht erforderlich), ausgewaschen und stellt dann einen ausgezeichneten Halbstoff dar, der im Holländer gebleicht und in Ganzstoff verwandelt wird.

Holzschleiferei und Holzstoff. Werner in Teisnach und Voith in Heidenheim (D. P. 19913) führen das Holz dem Schleifstein so zu, dass das Schleifen in einer Richtung geschieht, die weder quer noch parallel zur Faserrichtung ist.

Bei dem Holzschleifstein von Büttner in Weissenborn und Paschke in Freiberg i. S. (D. P. 19340) werden die Pressen durch hydraulischen Druck vor- und durch Vacuum zurückbewegt. Die Pressen der um eine waagerechte Achse rotirenden Steine befinden sich auf der ebenen Fläche desselben und stehen sich paarweise gegenüber.

Oeser in Penig. (D. P. 19458.) Vorrichtung zum Ausüben eines beständigen Drucks auf die Pressen von Holzschleifmaschinen. Das Räderwerk und die dadurch betriebene Kette zum Andrücken der Pressen wird von der Schleifsteinwelle durch eine elastische (von einer Kurbel hin- und herbewegte) Zugstange in Verbindung mit einem Schaltwerk in Bewegung versetzt.

Polster in Dresden und Oeser in Penig. (D. P. 20470 vom 12. April 1882.) Holzschleifapparat mit Ventilation und Stoffsortirung.

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Einrichtung der Abspritzvorrichtung an Holzschleifmaschinen. Hoffmann in Niederschlemma. (D. P. 20986 vom 4. Februar 1882.)

Neue Methoden der mechanischen Zerfaserung von Holz sind auch von Angermair in Ravensberg (D. P. 20140), von Zimmermann in Halberstadt (D. P. 20848) und von Freitag in Antonsthal (D. P. 20141) angegeben.

Schleifen von gedämpftem Holz. Eine Mittelstufe zwischen Holzschliff und Holzzellstoff, welche man dadurch erhält, dass das Holz vor dem Schleifen gedämpft wird, dient zur Herstellung von Einwickelpapier und der sogenannten „Lederpappen". (Pap.-Ztg. 1882, 685.)

Hierher gehört auch das Verfahren von Rasch in Hudiksvall und Kirchner in Aschaffenburg a. M. (D. P. 18447). Die Herstellung von braunem Holzstoff geschieht ohne Anwendung von Schleifapparaten und zwar durch Zerhacken gedämpfter Holzklötze auf einer Holzhackmaschine, Zerquetschen oder Vorzerfasern auf Kollergängen und Mahlen oder Fertigzerfasern auf einem Centrifugalholländer. Nach dem Zus. D. P. 19192 giebt gereinigtes Holz, in gleicher Weise behandelt, weissen Holzstoff.

Holzzellstoff durch Kochen mit Natron, Ammoniak. Dem Bericht über die Versammlung der Holzzellstofffabrikanten (Pap.-Ztg. 1882, 334) entnehmen wir, dass zur Zerkleinerung des Holzes statt des alten Verfahrens von Lee, nach welchem die Hölzer quer zur Faserrichtung zerkleinert werden, jetzt ein neues Verfahren in Cöslin angewendet wird, bei dem das Holz erst der Quere nach in Scheiben von 5 cm Dicke gesägt, dann in Plättchen von 4 mm Dicke nach Längsrichtung der Faser zerschnitten wird. Während diese Art der Zerkleinerung nach Kirchner-Aschaffenburg für den Kochprocess vortheilhaft ist, gehen die anderen Meinungen dahin, dass die Lee'schen Maschinen leistungsfähiger sind und das damit hergestellte Holz der Lauge eine bessere Circulation gestatte. Man soll altes abgelagertes Holz verwenden und erhält aus 1 cbm Holz etwa 100 kg trockenen ungebleichten Holzzellstoff. Knoesel-Alt-Damm spricht sich für langsames Kochen mit Natron aus, Dahl-Danzig und Kirchner für rasches Auslaugen, um den Zellstoff vor weiterer Zersetzung zu bewahren, weshalb der Kirchner'sche Auslaugeapparat*) empfohlen wird. Es wird im allgemeinen mit Lauge von 8 bis 12° B. gekocht. Die durch Auslaugen aus dem gekochten Holzzellstoff in Shank'schen Kästen erhaltene Lauge zeigt 10 bis 14° B. Sie wird abgedampft, calcinirt und dann nach Kirchner noch zweckmässig in einem besonderen Ofen geschmolzen, um die feinzertheilte Kohle zu zerstören. Der Lespermont'sche Wäscher, der vielfach eingeführt ist, wäscht zwar gut, liefert aber nur Lauge von höchstens 5° B. und zerschlägt den Stoff nicht genug. Die meisten Fabrikanten waschen darum in einem Holländer und bleichen dann in einem zweiten. Kirchner will in seinem Apparat alles Natron auswaschen und dann zur Bleiche nur 8 bis 10 kg Chlorkalk für 100 kg trocken gedachten Zellstoff verwenden.

*) Techn.-chem. Jahrb. 1883, 353.

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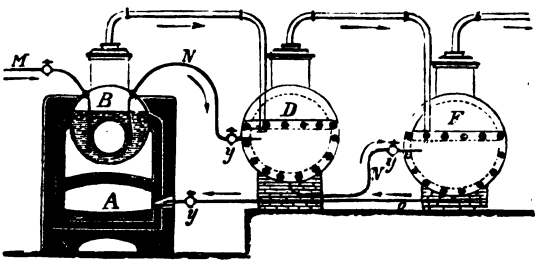
Zum Einbrausen von Natronlauge etc. in den Kocher wendet Röckner in Newcastle upon Tyne nach D. P. 19318 eine Brause an, die den Flüssigkeitsstralen eine solche Richtung giebt, dass sie den Kesselinhalt zu drehen streben.

Die Gesellschaft für Holzstoffbereitung in Grellingen (V. St. P. 256436; Pap.-Ztg. 82, 625) will das Holz mit Ammoniaklösung unter einem Druck bis 5 Atm. 4 bis 5 Stunden lang kochen, nach dem Erkalten soll sich das Harz oben abscheiden.

Soda aus der Holzzellstofflauge nach Störmer in Paris. (D. P. 21398 vom 3. Februar 1882.) Das Verdampfen der Lauge behufs Wiedergewinnung des Natrons geschieht in einer Reihe hintereinander liegender Kessel *BDF* in der Weise, dass der erste Kessel *B* durch directes Feuer, die folgenden je durch die heissen Abdämpfe des vorhergehenden Kessels geheizt werden, wobei die Lauge vom Auslaugeapparat durch das Rohr *M* fortwährend dem ersten Kessel zufliesst und von diesem durch Rohre *NN* und Hähne *y* durch die folgenden Kessel bis zum letzten gelangt, um von hier durch das Rohr *O* mit Hahn *y* auf den Herd *A* zu kommen, wo die vollständige Eindampfung und Calcinirung stattfindet.

Fig. 290.



Holzzellstoff durch Kochen mit Sulfiten. R. Mitscherlich beschreibt in der D. allgem. pol. Zeitschr. 9, 553 das ihm patentirte Verfahren zur Gewinnung von Holzzellstoff mit Calciumbisulfit. Das in Stücken zerkleinerte Holz wird in einem stehenden, innen verbleiten eisernen Kessel zunächst $^1/_2$ Stunde lang mit Dampf behandelt, wobei man das Condensationswasser abfliessen lässt. Man schliesst das Dampfventil und erhitzt dann das Holz (100 kg) mit 20 kg Calciumbisulfit, 20 l Salzsäure und 400 l Wasser, während 8 Stunden auf 110°. Das Holz wird dann zwischen Walzen oder auf einem Kollergange zerkleinert. Um einen für die Papierfabrikation möglichst wertvollen Stoff zu erhalten, der nicht noch gebleicht werden braucht, nimmt man weisse, möglichst harzfreie Hölzer, wie Pappeln, Weiden, Linden u. dergl.; es gehen hierbei besonders Eiweiss und Gummistoffe in Lösung. Handelt es sich weniger um ungefärbtes, als um starkes Papier, so wendet man Fichtenholz an und erhält hierbei hauptsächlich Harz in Lösung. Eichenholz kommt speciell zur Gewinnung von Gerbsäure in Anwendung; man wendet Temperatur von 114° an und vermeidet Eisen an dem Apparat. Man kann hier die einmal gebrauchte Lauge nochmals benutzen, bis sie genügend concentrirt ist; sie ist dann zum Gerben von Leder geeignet. Die in der Lauge vorhandenen Chemikalien sollen den

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Gerbprocess nicht verhindern, sondern eher befördern. Durch Zusatz von Eisenvitriol zur Lauge erhält man ohne weiteres eine brauchbare Tinte, da klebende Stoffe schon hinreichend vorhanden sind.

G. Archbold will das Mitscherlich'sche Verfahren so abändern, dass er in Stücke geschnittenes Stroh oder Holz zunächst 12 Stunden mit Kalkmilch kocht und dann die Masse 2 Stunden bei einem Druck von 4 bis 5 Atmosphären mit schwefliger Säure sättigt. Es wird hierauf die Fasernmasse ausgewaschen und mit einer Lösung von 3 Proc. Chlorcalium und $^1/_2$ Proc. Aluminiumsulfat unter Druck behandelt. (Ber. chem. Ges. 16, 350.)

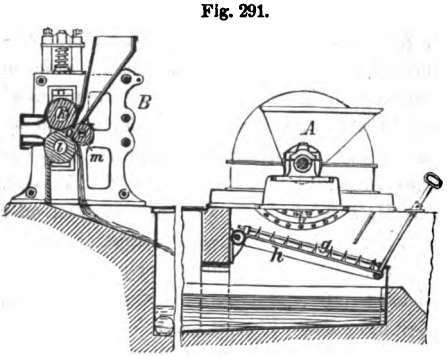
In Pap.-Ztg. 1882, 856 wird unter anderem auf ein Engl. P. No. 2924/1866 von Tilghmann aufmerksam gemacht, der Holz etc. mit schwefliger Säure ev. unter Zuhilfenahme von sauren schwefligsauren Salzen, besonders des Kalkes behandeln wollte. Tilghmann hätte demnach bereits ein ähnliches Verfahren geplant, wie solches von Mitscherlich eingeführt ist.

Ekmann in Bergvik, Am. P. 253357, Pap.-Ztg. 1882, 564, will Holz mit den sauren Sulfiten von Kali und Natron, vorzugsweise aber von Magnesia behandeln. Er benutzt hauptsächlich schwedisches Weisstannenholz, das in $^1/_2$—$^3/_4$ Zoll lange Stücke geschnitten und dann zwischen Walzen zerquetscht wird.

Papier aus Seepflanzen, Torf. Springer in London (Engl. Pat. 1445 vom 25. März 1882) will Cellulose aus Seepflanzen gewinnen, indem er diese zuerst gähren lässt, dann mit Alkali und Seifenlösung kocht und schliesslich mit Chlor bleicht.

Bei dem Verfahren von Friedrich in Plagwitz-Leipzig (D. P. 18115 vom 31. März 1881) wird zur Gewinnung von Torffasern für Pappe- und Papierfabrikation und gleichzeitiger Herstellung von Presstorf der Torf wie gewöhnlich gestochen, um dann mittelst einer Schleudermühle *A* zerfasert zu werden. Die Masse läuft über ein Sieb, durch dessen Oeffnungen ein Rechen *h* hindurchreicht. An der Spitze dieses Rechens werden die längeren, gestreckten Fasern zurückgehalten, die später abgenommen und zu Papier verarbeitet werden. Der durch die Spitzen des Rechens laufende Torfbrei wird mittelst der Walzenpresse *B* zwischen den Walzen *klm* entwässert und als Strang durch das Mundstück getrieben. Der Strang wird zerschnitten.

Fig. 291.



Bleicherei und Verhalten der Cellulose und Faser gegen Chlor und Säuren. Aimé Girard hat eine Schrift über Hydrocellulose veröffentlicht (Mémoire sur l'hydrocellulose et ses dérivés, Paris), von der Pap.-Ztg. 1882,

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84, einen Auszug bringt. Hydrocellulose ist eine Uebergangsstufe zwischen Cellulose $C^6H^{10}O^5$ und Traubenzucker $C^6H^{12}O^6$ und hat die Zusammensetzung $C^{12}H^{22}O^{11}$. Die Umwandlung bewirken Mineralsäuren, während organische Säuren nur vereinzelt wirken. So geht Cellulose, z. B. Baumwollenfaser, nach 12stündiger Behandlung in Schwefelsäure von 45° B. bei 15° in Hydrocellulose über, wobei die Faser brüchig und zerreiblich wird und nach dem Trocknen leicht in äusserst feinen Staub zerfällt. Salzsäure von 21° B. wirkt in 24 Stunden analog. Verdünnte Salzsäure wirkt in längerer Zeit oder bei höherer Temperatur in gleicher Weise; so wird selbst Baumwolle oder Papier mit nur 0·3 bis 0·4 Proc. Salzsäure nach 2 bis 3 Monaten ganz zerreiblich. Mit 3 bis 4 Proc. Salzsäure geht die Umwandlung bei gewöhnlicher Temperatur in einem Monat und bei 60 bis 70° C. schon in einigen Stunden vor sich. Die Faser, z. B. Hanffaser, hält geringe Salzsäuremengen mit ausserordentlicher Hartnäckigkeit fest, sie entweichen nicht beim starken Erhitzen, machen jedoch dabei die Faser brüchig. Kaustische Alkalien bewirken nicht die Umwandlung in Hydrocellulose. Neben Hydrocellulose bildet sich durch Säuren immer auch Traubenzucker, so dass beim Auswaschen ein entsprechender Verlust eintritt. Die Hydrocellulose wird durch Säuren rasch in Zucker verwandelt und durch Oxydationsmittel in Zucker- und Oxalsäure. Sie zeigt aber wichtige Unterschiede gegenüber Cellulose. So wird sie beim Erhitzen auf 60 bis 100° gebräunt, indem sich durch Oxydation Ulminsäure bildet, die man auswaschen kann. Während Cellulose durch kaustisches Kali oder Natron von 40° B. nur aufgebläht wird, wird die Hydrocellulose gleichzeitig völlig zersprengt und zum Zerplatzen gebracht. Mit der durch Alkalien aufgeblähten Cellulose (nach Mercer als „mercerisirte" Faser bekannt) hat sie insofern Aehnlichkeit, als sie auch — jedoch stärker — durch Jod blau gefärbt wird und ebenfalls Farben sehr leicht annimmt. Diese Beobachtungen sind für die Papierfabrikation wichtig. Nach Verf. wirkten selbst concentrirte Lösungen bleichender Chlorverbindungen nicht schädlich auf Papier, so lange nicht unterchlorige Säure, durch die Kohlensäure der Atmosphäre frei gemacht, zu Chlorwasserstoff geworden ist; letztere übt dann ihren zerstörenden Einfluss aus. Noch mehr findet sich beim Bleichen mit Chlorgas Gelegenheit zur Bildung von Chlorwasserstoffsäure. — Ein Erfinder will die Hydrocellulose an Stelle von Wollstaub zur Fabrikation von Sammetpapier etc. benutzen.

Nach Pap.-Ztg. 1882, S. 337 soll jetzt unterschwefligsaurer Baryt als Antichlor verwendet werden, wobei durch Oxydation sich schwefelsaurer Baryt bildet, der zum Weissen des Stoffes dient.

Harzleimung. Da bei der vegetabilischen Leimung im Holländer bei Umsetzung von harzsaurem Natron durch schwefelsaure Thonerde Natriumsulfat frei wird und ins Wasser übergeht, empfiehlt Lieber (Pap.-Ztg. 1882, S. 850), schliesslich dem Brei Chlorbaryum hinzuzusetzen, um in demselben Blanc fixe zu erzeugen. Ueber die saure Reaction von mit Harz geleimtem Papier s. Feichtinger (Dingl. polyt. Journ. Bd. 245, S. 174; Bd. 247, 218) und Haenlin (ib. Bd. 246 S. 195 und Bd. 247 S. 382).

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Hadernschneider s. Baumann, D. P. 20328, u. Braker Söhne, D P. 20754.

Holländer. Holländer-Grundwerk, Korschilgen in Berg. Gladbach (D. P. 18875). Die Messer des Grundwerkes umschliessen die Walze auf einem grösseren Teil des Umfanges und sind radial gestellt. Nach dem Zusatz, D. P. 20748, kann das Grundwerk auch aus Stein hergestellt werden, wobei es mit Furchen statt der Messer versehen wird.

Der Halbzeugholländer von Cobley in Dunstable und Tidcombe jr. in Watford (D. P. 20131) ist durch Dampf heizbar und besitzt einen abnehmbaren Verschlussdeckel.

Holländer von W. Umpherston m. Ab. (Pap.-Ztg. 1882, S. 24.)

Papier- und **Pappenmaschine.** Die Cylinder-Pappenmaschine von Lein in Mulda (D. P. 19336) enthält anstatt eines endlosen Filztuches zur Abnahme und Uebertragung des auf dem Cylinder gebildeten Papiers nach den Presswalzen eine mit Filz überzogene Walze, welche zwischen den Oberflächen des Cylinders und der unteren Presswalze rollt. Neuerung an Windhaspeln, Hoesch in Düren (D. P. 18122). — Reinigen von Sieben, Filzen etc. bei Papiermaschinen, Kleinlogel in Wildbad (D. P. 18571. — Papierstoffsortircylinder, Hoeld & Co. in Villingen. (D. P. 18882 vom 5. Januar 1882.) — Langsieb-Cylinder-Papiermaschine, Stenger in Frohnleiten. (D. P. 19193 vom 13. Januar 1882.)

Knotenfänger und Stoffreinigung. Rotirender und doppeltwirkender Knotenfänger von L. L'huillier in Vienne. (Pap.-Ztg. 1882, S. 1534.)

Burnett (V. St. P. 258710 d. Pap.-Ztg. 1882, S. 936) will den fertigen Stoff durch Magnete von Stahl- und Eisenteilen befreien und beschreibt einen geeigneten Apparat.

Trockenvorrichtungen. Apparat zum continuirlichen Trocknen von Buntpapier und Tapeten. (D. P. 19849.) Heissluftrockencylinder-Einrichtung, Seidler in Schweinfurt. (D. P. 20852.)

Frictionseinrichtung an mehrwalzigen Kalandern, Voith in Heidenheim. (D. P. 18412.)

Ueber Sicherheitsvorrichtungen an Kalandern zur Verhinderung dessen, dass die Arbeiter beim Anlegen der Bogen mit den Fingern zwischen die Walzen geraten. (Pap.-Ztg. 1882, S. 370 m. Abb.) Satinirmaschine, F. Hehm & Co. in Offenbach a. M. (D. P. 17257.)

Pergamentpapier. Treibriemen aus Pergamentpapier, Belgisches Patent von P. Neumann in Brüssel (Pap.-Ztg. 1882, S. 524), wonach eine grössere Anzahl von Bogen direct aus dem Pergamentirungsbade auf einander gepresst und dann erst ausgewaschen wird.

Nach dem D. P. 20842 von Sachsenröder in Barmen werden Gewebe mit Pergamentpapier in der Weise vereinigt, dass das Gewebe auf das aus dem Pergamentirbade tretende Papier geleitet wird, mit ihm durch ein Paar Druckwalzen und von hier in das Wasserbad geht.

Durch Bestreichen des gewöhnlichen Pergamentpapiers mit einer etwas Glycerin enthaltenden Gelatinelösung und Trocknenlassen erhält man ein

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fettdichtes Material. Durch Tränken von Pergamentpapier mit Benzol oder Schwefelkohlenstoff, die 1 Proc. Leinöl und 4 Proc. Kautschuk aufgelöst enthalten, gewinnt man ein Einwickelpapier für zerfliessliche Droguen. (Pharm. Centralh. 24, 177.)

Papiererzeugnisse. Wasserdichtmachen von Papier mittelst Paraffin etc., Apparat, Ridgeway. (V. St. P. 257761.) Pap.-Ztg. 1882, S. 1088.

Lederpappe aus Holz und Rinde s. Allen (V. St. P. 253656), Pap.-Ztg. 1882, S. 789. Der Stoff soll mit einer Masse aus Asphalt, Oel, Harz und Alkali in einem geheizten Holländer geleimt werden.

F. J. Heilemann in Berlin. D. P. 18220 vom 23. August 1881. Herstellung von Schüsseln und Schalen aus Pappe.

Ueber Eisenbahnräder aus Papier nach einem Vortrag von Hennig, sowie über Benutzung von Asphaltpapier als Zwischenlage zwischen Schienen und eisernen Stuhl bezw. eiserner Schwelle. (Pap.-Ztg. 1882, S. 1008.)

Marmoriren. (Pap.-Ztg. 1882, S. 854, 882, 912, 1132, 1228, 1384, 1452.

Nach Pap.-Ztg. 1882, S. 1312 erhält man ein wasserdichtes, im Dunklen leuchtendes Papier aus 10 Tln. Wasser, 40 Tln. Papierganzzeug, 10 Tln. phosphorescirendem Pulver, 1 Tl. Gelatine und 1 Tl. Kaliumbichromat.

Arthur Lehmann.

Statistik.

Im Deutschen Reich betrug, in metr. Centnern ausgedrückt, die

Waarengattung.	Einfuhr		Ausfuhr	
	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.	vom 1. Januar bis Ende December 1882.	vom 1. Juli 1882 bis Ende Juni 1883.
an Halbstoff zur Papierfabrikation	38 810	24 383	216 882	240 424
„ grauem Lösch- und Packpapier aller Art	12 310	10 901	87 200	90 671
„ Pappe aller Art und Pressspäne	17 047	16 192	214 685	198 296
„ anderem Papier	23 223	22 197	247 676	261 804
„ Papiertapeten	1 258	1 118	23 223	23 863

XXXV. Photographie und andere graphische Verfahren.

Negativprocesse. Trockenverfahren. Das Gelatineverfahren findet wegen seiner Einfachheit und Empfindlichkeit immer mehr Eingang und wird die nassen Verfahren vielleicht ganz verdrängen. Die Emulsion von H. W. Vogel, eine Combination von Gelatine und Collodium, ist schon im vorigen Jahrgang erwähnt worden.*)

*) Techn.-chem. Jahrb. 1883, S. 362.

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Plener in London entfernt aus den auf gewöhnliche Weise hergestellten Emulsionen die ungelösten Silbersalze durch Ausschleudern in einem kegelförmigen innen versilberten Gefässe, an dessen Wände jene Salze sich als compacte Masse ablagern. Man kann auf diese Weise aus unbrauchbaren Emulsionen das Bromsilber wieder gewinnen. Das Gefäss soll pro Minute 4000 Umdrehungen machen. (D. P. 20733 vom 3. Mai 1882.) Die Lösung wird dann mittelst eines Hebers entfernt; der Rückstand wird mit warmem Wasser ausgewaschen und kann wieder für eine Gelatine-Emulsion gebraucht werden.

Um colorirte Photographien herzustellen, verfahren Chaine, Durand und Sallonier de Chaligny in Lyon folgendermaassen: Die Photographien werden zunächst transparent gemacht, dann auf der Rückseite mit Oelfarbe bemalt und schliesslich getrocknet. Die dabei verwendeten neuen Apparate sind: eine heizbare Wanne zur Aufnahme des Bades zum Transparentmachen, ein heizbarer Arbeitstisch und ein Trockenschrank. (D. P. 22675.)

Im Kohledruckverfahren ist eine Neuerung von J. Baumgartner in Lörrach zu erwähnen. Dieselbe besteht in der Anwendung von Pigmentpapieren, welche, je nach dem zu erzielenden Effect mit mehreren aufeinander liegenden Schichten von verschiedener Farbe versehen sind. Lösungen von 2 bis 10 g Gelatine pro 100 cbcm Wasser werden mit Farben versetzt. Alle nicht durch chromsaures Kali zersetzbaren Farben in ganz feinem Pulver oder in Lösung, können dazu verwendet werden. Die zweite Farbschicht wird auf die erste aufgetragen, sobald diese erstarrt und trocken ist. Unmittelbar vor dem Gebrauch werden die so vorbereiteten Papiere durch Eintauchen in eine Chromatlösung lichtempfindlich gemacht. Nach der Belichtung werden die löslich gebliebenen Farbenschichten abgewaschen. (D. P. 20966.)

Morgan & Kidd in Greenwich stellen empfindliches Papier für photographische Zwecke her (Engl. P. 2780 vom 13. Juni 1882), indem feines Papier erst mit einer Säure behandelt wird, um Mineralstoff zu entfernen, ausgewaschen, dann mit einer Lösung von Gelatine, Stärke, Gummi und Alaun, in welcher Asbest, Talk, Kaolin suspendirt ist, bestrichen, zwischen polirten Platten gepresst, wieder wie vorhin bestrichen, mit Wachs geglättet und schliesslich mit einer Gelatine-Emulsion von Bromsilber überzogen wird.

Robert Taverner Wall in Longfleet (D. P. 22568) stellt eine empfindlich machende Lösung aus weissem Pfeffer her, den er mit Aether, Terpentin, Alkohol, Naphta, Chloroform oder Benzin und dgl. oder mit ätherischen und flüchtigen Oelen, Phenol, Säuren oder mit Mastix, Copal, Sandrak oder photographischem Weingeistfirniss macerirt. Man stellt z. B. eine Tinctur aus $^1/_2$ kg weissen Pfeffer und $^1/_2$ bis 1 l Aether her. Beim Gebrauch wird etwas Terpentinöl oder Terpentinfirniss zugesetzt. Die Lösung wird auf die empfindlich zu machende Fläche gegossen und dieselbe wie gewöhnlich exponirt.

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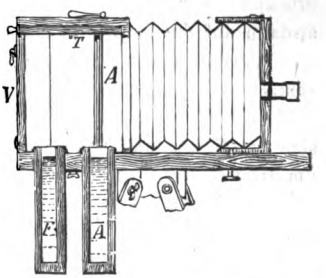
Ateliereinrichtungen. Jean Baptiste Feilner in Bremen stellt Abtönungsvignetten her durch Photographiren von Papierschablonen, welche, auf Glasplatten aufgeklebt, in der Grösse und im Verhältniss gleichweit aufeinander folgen. Das Photographiren geschieht, indem diese Glasplatten in bestimmter Reihenfolge mit matten Glasscheiben abwechselnd, in einem gegen seitliches Licht abgeschlossenen Kasten vor der Linse eines Portraitobjectivs angeordnet sind. (D. P. 20740.)

Franz Stolze in Berlin stellt Vignettirmasken durch fette Schwärze auf Diaphanpapier her. Nach irgend einer photographischen Methode macht man im Copirrahmen unter einer gewöhnlichen Vignettirmaske ein Positiv einer Abtönung, welches nun seinerseits benutzt wird, um auf einer Lichtdruckplatte ein Negativ zu erzeugen, nach welchem dann beliebig viele Abdrücke auf Diaphanpapier gemacht werden können. Um mit ihrer Hilfe abgetönte Bilder zu copiren, ist es nur nötig, eine solche Schablone in passender Stellung auf der Glasseite eines Negativs zu befestigen und es wie jedes andere Negativ zu copiren. (D. P. 22421.)

Von sonstigen Ateliereinrichtungen erwähnen wir noch das D. P. 20821 von William Kurtz in New-York. Um Licht und Schatten auf den exponirten Gegenständen nach Belieben wechseln zu können, ohne an den Ateliereinrichtungen etwas ändern zu müssen, befindet sich der zu exponirende Gegenstand und die Camera obscura auf einer um einem Zapfen drehbaren Plattform, so dass bei einer Drehung der letzteren die Camera obscura und der exponirte Gegenstand in derselben Lage zu einander bleiben.

Paul Rouaix in Paris hat einen Apparat zur Aufnahme von Photographien ohne Dunkelkammer angegeben. (D. P. 21580.) Die in den Deckel an Stelle der matten Scheibe eingesetzte Collodiumplatte *A* befindet sich in der gezeichneten Lage über der Cuvette *A* mit dem Silberbade. Um die Platte empfindlich zu machen, wird die Cuvette heraufgeschoben, so dass die Platte genügend lange mit dem Bade in Berührung bleibt. Wird nun das Objectiv geöffnet, so nimmt die Platte das Bild auf. Um dieses hervorzurufen, wird nach Schluss des Objectivs der Schieber *p* so weit zurückgeschoben, dass sein Anschlag *T* gegen die Tür *V* stösst; in dieser Stellung befindet sich die Platte über der Cuvette des Hervorrufungsbades *F*, welche dann wie oben über die Platte geschoben wird.

Fig. 292.



Umdruckverfahren und Sontiges. John Matthew Moss in Patricroft stellt die Zeichnung durch Lichtdruck auf einem mit einer Schicht Gelatine überzogenen und durch Behandlung mit Kaliumbichromat lichtempfindlich gemachten Stück Papier oder Stoff (Cattun) her. Hierauf lässt er die unverändert gebliebenen Stellen der Gelatine durch Befeuchten aufquellen. Die aufge-

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quollenen Teile werden mit Druckfarbe versehen und auf die zu ätzende Fläche umgedruckt. (D. P. 20862.)

Weidemann in Berlin überzieht die Zinkplatten mit einer Auflösung von Wachs und Paraffin im Schwefeläther. Hierauf wird ein zweiter Ueberzug angebracht, welcher dadurch hergestellt wird, dass man 1 kg Gelatine und 0·25 kg Weizenstärke in Wasser löst und dieser Lösung 1 kg Zinkweiss oder schwefelsauren Baryt und etwa 20 g Glycerin zusetzt. (D. P. 20487.)

Ein Verfahren zur Herstellung von Gravirungen auf ebenen und gekrümmten Flächen von Alfred Michaud in Paris besteht darin, dass man sich photographischer Clichés zur Herstellung sogenannter künstlich gezeichneter Negative bedient, indem man eine Glasplatte anwendet, die mit einer Silberpulver festhaltenden Masse überzogen ist, wodurch eine gegen die Lichtwirkung empfindliche Oberfläche gebildet wird. (D. P. 22628.)

Photographische Platten für Hoch- und Tiefdruck-Clichés stellt Georg Meisenbach in München folgendermaassen her. Von einer Fläche, welche mit mehr oder weniger weit abstehenden Linien schraffirt oder durch Punkte oder sonstwie in gleichmässige Muster abgeteilt ist, wird auf eine transparente Platte (Glasplatte) ein photographisches Negativ genommen. Auf einer anderen ebenfalls transparenten Platte wird ein photographisches Negativ des zu reproducirenden Gegenstandes hergestellt. Auf diese Negativplatte wird das schraffirte oder punktirte Negativ gelegt und von dieser combinirten Platte ein Negativ auf gewöhnliche photographische Weise erzeugt, wobei zur Erzielung von Durchkreuzungen, das schraffirte Negativ öfters verschoben wird. Das so erhaltene Negativ wird nun auf eine ätzbare Platte aus Metall oder Glas übertragen und letztere durch Aetzung in das gewünschte Hochdruck-Cliché umgewandelt. Zur Herstellung von Tiefdruckplatten wird das letzte Negativ in ein Positiv verwandelt und dieses alsdann auf die ätzbare Platte übertragen.

Anstatt das Negativ des zu reproducirenden Objects und dasjenige der schraffirten Fläche je auf eine gesonderte Platte zu bringen, kann man auch beide auf eine gemeinschaftliche Platte bringen und diese dann, wenn es sich um Herstellung von Tiefdruckplatten handelt, direct oder, wenn es sich um Herstellung von Hochdruck-Clichés handelt, durch Vermittelung eines herzustellenden Positivs für die Uebertragung auf das Metall etc. zu benutzen. (D. P. 22244.)

Siepmann & Pustet in Iserlohn haben ein Lichtdruckverfahren, um Metallgegenstände mit ihrem Metallglanz zu vervielfältigen, angegeben. (D. P. 20183.) Dabei wird nicht, wie bisher, der ganze Grund mit dem Bindemittel für die Bronze bedruckt, sondern nur diejenigen Stellen, welche den Metallglanz am kräftigsten zeigen sollen, in nach dem Schatten zu abnehmender Weise. Es wird ein photographisches Negativ hergestellt, mit einer Gelatinelösung übergossen und nach dem Trocknen mit Negativlack überzogen. Die vom Glas gezogene Haut, an welcher der Silberniederschlag haftet, dient zur Herstellung eines Diapositivs. Legt man Positiv und

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Negativ auf einander, so ergiebt sich ein gleichmässig grauer Ton. Nachdem man auf dem Diapositiv alles abgedeckt hat, was nicht mitgedruckt werden soll, fertigt man nach demselben, sowie nach dem Negativ, je eine Lichtdruckplatte. Man druckt zuerst mittelst der vom Diapositiv copirten Platte Metallfarbe auf. Diese Abdrücke werden dann mit der vom Negativ copirten Druckplatte mit Schatten in Schwarz oder dergl. versehen.

Nach einem Verfahren für Glasmalerei von Godard in Paris werden die Glasplatten mit einer lichtempfindlichen Schicht, welche aus einer Lösung von 5 g Dextrin oder Traubenzucker in 100 g Wasser, mit einem Zusatz von chromsaurem Ammoniak besteht, überzogen. Nach dem Trocknen derselben legt man die Platten in einem Copirrahmen auf die betreffenden Zeichnungen, und exponirt sie dem Licht. Nach genügender Belichtung wird die fein gepulverte und trockne Glasfarbe in einem dunklen Zimmer aufgestrichen, hierauf werden die Glasscheiben in einem Bade aus 1000 g Methylalkohol und 30—40 g Salpetersäure gewaschen, wobei nur die gefärbten Partieen stehen bleiben. Darauf wird die Farbe in gewöhnlicher Weise eingebrannt. (D. P. 20599.)

Schmidt & Vehl in Berlin haben ein Verfahren zur Herstellung von Bildern etc. auf Papier, welche bei dessen Anfeuchtung sichtbar werden und beim Trocknen verschwinden, angegeben. (D. P. 19219.) Die Zeichnung wird mittelst einer Flüssigkeit auf das Papier gebracht, welche aus 1 Tl. Leinöl, 20 Tlen. Ammoniaklösung und 100 Tlen. Wasser besteht.

XXXVI. Organische Säuren.

Tirolf, Montigny bei Metz, beschreibt die Anwendung eines Zerstäubers in der Schnellessigfabrikation. Das Essiggut fliesst aus einem höher gelegenen Reservoir durch das Rohr *g* und von diesem durch Gummischläuche *h* in den Zerstäuber *l*, in welchem zur Zerstäubung des Essiggutes comprimirte Luft durch Rohr *i* und Gummischlauch *k* geleitet wird. Aus dem Zerstäuber gelangt das Essiggut in den Essigbilder. (D. P. 20717.)

Fig. 293.

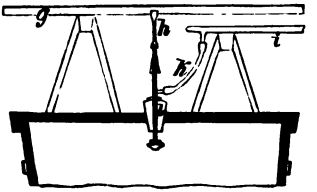
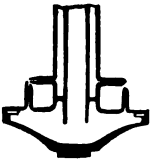


Fig. 294.



Luck in London (D. P. 19280) benutzt statt des üblichen Korbgeflechtes an welchem der Alkohol behufs Fabrikation von Essig oder Cognac herunterrieselt, während Luft oder sonstige Gase entgegenströmen, einfache oder zusammengesetzte oder geflochtene Schnüre, Bänder oder gewebtes Zeug,

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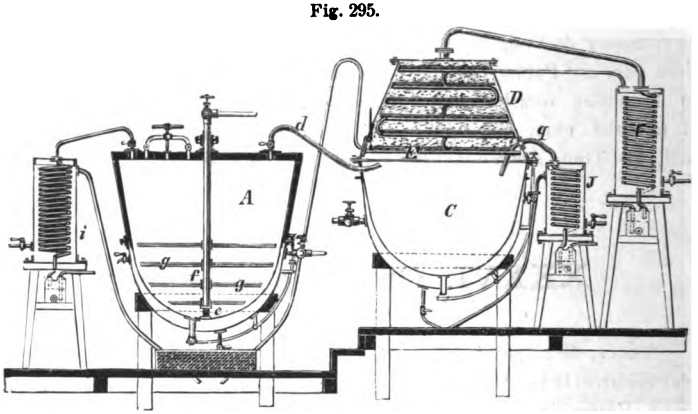
welche an zwei Leisten mit Nuten so angebracht sind, dass sie durch das Gewicht der unteren Leiste straff gehalten werden.

Von D. Sandmann in Charlottenburg (D. P. 21155) sind neue Apparate angegeben worden, mittelst deren aus holzessigsaurem Kalk oder anderen Acetaten durch einmalige Destillation direct Eisessig oder hochgradige Essigsäure gewonnen werden soll. Der Apparat besteht aus einer Combination von zwei Destillirblasen *A* und *C* und drei Kühlern *i J F*. Die Destillirblase *A* ist ein Kessel mit Dampfdoppelboden aus Kupfer und emaillirtem Eisen, welcher mit einem steinernen Deckel, und im oberen Teile mit einer Bekleidung aus Chamotte versehen ist. Als Rührwerk dient ein um das Dampfrohr *e* gelegtes mit Armen *g* versehenes Rohr *f*. Die Destillirblase *C* trägt die mit ihrer inneren Einrichtung als Dephlegmator wirkende Haube *D* mit der in horizontaler Richtung spiralförmig gewundenen aus mehreren Etagen bestehenden Kühlschlange *E* beide aus emaillirtem Eisen. Auf den Etagen werden Glasstreifen gelagert und die Räume zwischen denselben vollständig mit Glas- oder Porcellanstücken angefüllt.

Fig. 295.



Der gemahlene, essigsaure Kalk wird mit der erforderlichen Menge Säure mittelst des Rührwerkes *f* gut durchgerührt und sofort der Destillation unterworfen. Die sich entwickelnden Essigsäuredämpfe treten durch das Uebergangsrohr *d* in den Kessel *C*, werden hier durch die Dampfheizung heiss erhalten und durch die Dephlegmationseinrichtung der Haube in sich condensirende starke und überdestillirende sehr schwache Essigsäure zerlegt. Die unten im Kessel *C* sich ansammelnde Essigsäure gelangt immer wieder zur Destillation bis nach Steigen der Temperatur auf 118° sie fast wasserfrei durch das Uebergangsrohr *q* abdestillirt werden kann. Die im Destillationsrückstande von Kessel *A* noch vorhandene Essigsäure wird mit directem Dampf (aus Dampfrohr *e*) abgetrieben und in der Kühlschlange *i* condensirt. Etwaige Zusätze zur Reinigung der Essigsäure, wie Kaliumpermanganat oder Natriumacetat gelangen in den Kessel *C*.

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Richard Hengstenberg in Esslingen am Neckar (D. P. 20680) berichtet über ein Staffelessigbilder-System. Die Essigbilder sind staffelförmig übereinander aufgestellt und stehen durch Hähne und Trichter mit einander in Verbindung; die successive Sättigung der Späne mit dem Essiggut erfolgt durch Rohre, die von den Trichtern bis nahe auf den Boden der Essigbilder geführt sind.

Zum Füllen der Essigbilder empfiehlt J. Bersch (Oesterr. Liqueurfabr. 1882, S. 3) Korkabfälle.

Ueber synthetische Oxalsäure von N. Merz und W. Weith (Ber. chem. Ges. **15**, 1507). Ameisensäure kann leicht und in grosser Menge aus Kohlenoxyd und Aetznatron erhalten werden. Natrium- oder Kaliumformiat andererseits werden durch rasches Erhitzen leicht in oxalsaure Salze übergeführt. Nach den Versuchen der Verfasser liefert Natriumformiat, wenn es unter möglichst vollständigem Ausschluss der Luft stürmisch auf 400° erhitzt wird, 70 Proc. und mehr Dinatriumoxalat neben kohlensaurem Natron. Bei niedrigerer Temperatur, schon bei 360°, überwiegt das kohlensaure Salz. Das Kaliumsalz muss auf eine noch höhere Temperatur erhitzt werden, um gute Ausbeuten zu erhalten. Calcium-, Barium- und Magnesiumformiat liefern beim Erhitzen nur kohlensaure Salze. Zur Darstellung der Oxalsäure würde sich hiernach am besten das Natriumsalz eignen. Man erhält das Dinatriumoxalat leicht rein durch Abwaschen mit etwas kaltem und Umkrystallisiren aus heissem Wasser. Wenn der Process im grossen ebenso günstig verläuft, wie dies bei kleinen Mengen der Fall ist, so dürfte diese Darstellungsmethode mit Rücksicht auf Ausbeute und Reinheit des Products dem bis jetzt gebräuchlichen Verfahren (aus Sägemehl und Aetzkali) vorzuziehen sein.

Bestimmung der Weinsäure im Weinstein und in der Weinhefe von P. Carles. (Journ. de Pharm. et de Chim.) Der Verfasser macht von dem Weinstein zunächst eine acidimetrische Bestimmung, dann nach der Veraschung einer neuen Probe eine alkalimetrische Bestimmung der löslichen Salze. Das Resultat der Säurebestimmung liefert die Hälfte der als Weinstein vorhandenen Weinsäure, die alkalimetrische Bestimmung ergiebt die Gesamtmenge des dem Weinstein entsprechenden kohlensauren Kaliums. Ist weinsaures Calcium zugegen, so behandelt man mit einer Mischung von gleichen Teilen Salpetersäure und Wasser filtrirt und neutralisirt mit Ammoniak. Das ausgewaschene Calciumtartrat wird ausgewaschen und gewogen.

Ludwig Erckmann in Alzey hat ein Verfahren zur Gewinnung von Weinstein aus Drusen (D. P. 19770) angegeben: Die Drusen, auch Weinhefe oder Geläger genannt, enthalten eine in bestimmten Grenzen wechselnde Menge Weinstein und auch etwas weinsauren Kalk. Zur Abscheidung dieser weinsauren Salze von beigemengter schmieriger Masse, bestehend in der Hauptsache aus Hefenzellen und Eiweissstoffen, wird die abdestillirte und mit Wasser hinreichend verdünnte Weinhefe heiss in die Centrifuge eingeführt, welche innen und aussen mit Dampf geheizt ist. Die Centrifuge wird hinreichende Zeit in Rotation versetzt, alsdann wird getrennt und die unten in der Centrifuge sitzende heisse

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Weinsteinlösung sofort abgezapft und, wie bekannt, in Krystallisationsbottichen erkalten gelassen, wobei sich der Weinstein ziemlich rein ausscheidet. Der grösste Teil der verkochten Hefenzellen und sonstiger Unreinheiten sitzt fest an der inneren Wand der Centrifugentrommel und wird mit einer Blechschaufel entfernt: die Centrifuge ist nun zu einer weiteren Beschickung geeignet. Die in der Centrifuge sitzende Hefenmasse enthält selbstverständlich eine dem zurückgehaltenen Wasser entsprechende Menge Weinstein, sie kann daher nochmals mit heissem Wasser gekocht und geschleudert werden oder wird mit Salzsäure versetzt in Filterpressen abgepresst und die Lösung wird auf weinsauren Kalk verarbeitet. Auch aus der zum zweitenmale geschleuderten Hefenmasse, welche nur noch wenig weinsauren Kalk enthält, wird am zweckmässigsten weinsaurer Kalk dargestellt.

W. Will.

XXXVII. Alkaloide.

1. Sauerstofffreie Alkaloïde.

Pyridinbasen. Die Constitution dieser Basen ist in neuerer Zeit etwas aufgeklärt worden. Einige der Pyridinbasen sind aus Aldehyden der Fettreihe syntethisch dargestellt worden, so z. B. das Picolin aus Acroleïn-Ammoniak und durch Erhitzen von Tribromallyl mit alkoholischem Ammoniak, so das Collidin aus Aldehydammonik oder aus Aethylenbromid mit Ammoniak. Ciamician und Dennstedt (Ber. chem. Ges. 15, S. 1172) haben Pyridinderivate aus Pyrrol dargestellt, so z. B. das Monobrompyridin durch Erhitzen von Pyrrolkalium mit Bromoform etc.

Chinolinbasen. Auch diese sind seit der Synthese des Chinolins von Skraup (Monatshefte für Chemie I. 317) mittelst Anilin, Nitrobenzol, Glycerin und Schwefelsäure näher untersucht worden. Skraup hat in analoger Weise (D. P. 14976) Oxychinoline aus den drei Amidophenolen dargestellt, welche zu sanitären Zwecken und zur Farbenfabrication Verwendung finden. Ferner seien erwähnt:

J. Donath. Antipyretische und antiseptische Eigenschaften des Chinolins. (Ber. chem. Ges. 14, 1769.) Derselbe: Verhalten des Chinolins zu chemischen Reagentien (Ber. chem. Ges. 14, 1771), Verhalten im Organismus. (14, 1773.) S. Hoogewerff und W. H. van Dorp: Ueberführung der Chinolinsäure in Nicotinsäure durch Eisessig. (Ber. chem. Ges. 14, S. 974.)

Eine dem Chinolin homologe Base, das Chinaldin, ein Methylchinolin, ist von O. Doebner und W. von Miller (Ber. chem. Ges. 15, S. 30, 75) aus Anilin, Nitrobenzol, Aldehyd und Schwefelsäure dargestellt worden. (S. S. 495) wobei sich zunächst Crotonaldehyd (Methylacroleïn) bildet.

Durch Anwendung von Zimmtaldehyd (Phenylacroleïn) an Stelle des Acetaldehyds erhielten die Genannten (Ber. chem. Ges. 16, 1664) das Phenyl-

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chinolin (C^6H^5) C^9H^6N. Ueber einen Gehalt des Steinkohlenteerchinolins an Chinaldin und über aus dem letzteren mittelst Phtalsäureanhydrid darstellbare Farbstoffe haben E. Jacobsen und C. B. Reimer (Ber. chem. Ges. 16, 1082 und 2602) berichtet.

Paul Friedlaender und G. F. Gohring (Ber. chem. Ges. 16, S. 1833) beschreiben die Darstellung einer Reihe im Pyridinkern substituirter Chinolinderivate aus Amidobenzaldehyd und verschiedenen Aldehyden und Ketonen unter der Einwirkung verdünnter Natronlauge.

Piperidin, welches aus Piperin durch Kochen mit alkoholischer Kalilösung gebildet wird, steht nach Versuchen von Koenigs (Ber. chem. Ges. **12,** 2341) und von Hofmann und Schotten (Ber. chem. Ges. **15,** 427) in einer nahen Beziehung zu Pyridin, insofern daraus durch Behandlung mit Brom unter geeigneten Bedingungen Derivate des Pyridins erhalten werden, so wie ja auch Piperidin durch Reduction des Pyridins mit Zinn und Salzsäure dargestellt werden kann (Ber. chem. Ges. **16,** 1856). Aus dem Piperidin ist von Hofmann (Ber. chem. Ges. **14,** 659) ein Kohlenwasserstoff erhalten worden, indem das Oxydhydrat des Trimethylpiperylammoniums $(C^5H^9CH^3)(CH^3)^2NOH$, bei der Destillation in Trimethylamin und diesen Kohlenwasserstoff, das Piperylen C^5H^8 gespalten wurde. Vielleicht ist derselbe mit dem von Reboul gefundenen Valerylen identisch.

Coniin. In analoger Weise wie aus dem Piperidin ist auch aus dem Coniin ein Kohlenwasserstoff C^8H^{14}, das Conylen, dargestellt worden. Das Coniin erscheint hiernach als ein einfaches Homologes des Piperidins. Die Zusammensetzung des Coniins ist nicht, wie Planta und Kekulé angegeben haben, $C^8H^{15}N$, sondern $C^8H^{17}N = C^8H^{16}NH$. Eine gewisse Aehnlichkeit der toxikologischen Eigenschaften des Piperidins und Coniins hat sich herausgestellt (Hofmann). Darstellung und Eigenschaften des Coniins und seiner Salze beschreibt J. Schorm (Ber. chem. Ges. 14, S. 1765).

Nicotin. Zur quantitativen Bestimmung des Nicotins im Tabak hat J. Skalweit (Repert. f. anal. Chem. 1881, 165—168) eine neue Methode angegeben. Hiernach werden 20·25 g Tabakspulver mit 10 cbcm Normal-Schwefelsäure und 200 cbcm absol. Alkohol zwei Stunden lang am Rückflusskühler gekocht, auf 250 cbcm mit Alkohol aufgefüllt, hiervon 100 cbcm durch Destillation von der Hauptmenge des Alkohols befreit, mit 30 cbcm Kalilauge von 1·16 sp. Gew. versetzt, destillirt, bis das Destillat nicht mehr alkalisch reagirt und letzteres mit $^1/_{10}$ Normal-Schwefelsäure titrirt. Das spec. Gewicht des Nicotins ist von demselben Chemiker (Ber. chem. Ges. 14, S. 1809) zu 1·0111 bestimmt worden. Bei der Destillation mit Wasserdämpfen tritt Zersetzung des Alkaloids ein. Ohne Zersetzung zu erleiden, kann es nur im Wasserstoffstrome destillirt werden. (Repert. anal. Chem. 1881, 303.) Eine Kritik der Skalweit'schen Nicotinbestimmung giebt R. Kiessling (Zeitschr. anal. Chem. **20,** 514 und **22,** 199). Derselbe unterzieht (Zeitschr. anal. Chem. **24,** 34) alle zur Bestimmung des Nicotins im Tabak empfohlenen Methoden einer eingehenden Besprechung und giebt eine aus-

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führliche Beschreibung seines eigenen Verfahrens. Im allgemeinen sind die trockenen dünnen Tabakblätter nicotinarm, die dicken saftreichen nicotinreich. Derselbe (Dingl. pol. Journ. **244**, 64 und 234) hat Bestimmungen des Nicotingehalts im Cigarrenrauch ausgeführt und gefunden, dass von den giftigen Bestandteilen des Tabakrauches nur Nicotin, nicht aber (wegen ihrer unbedeutenden Mengen) Kohlenoxyd, Schwefelwasserstoff, Blausäure und die Picolinbasen hinsichtlich ihrer Wirkung auf den Organismus in Betracht kommen. (S. a. H. Dragendorff, Zeitschr. anal. Chem. **21**, 383.)

Eine dem Nicotin isomere Base, das Isonicotin ist von H. Waidel und M. Rousseau (Monatshefte für Chemie III., 850) durch Einwirkung von Natrium auf Pyridin und Reduction des dabei entstehenden Dipyridins mittelst Zinn und Salzsäure erhalten worden. Dasselbe krystallisirt in bei 78° schmelzenden, zerfliesslichen Nadeln, die beim Erhitzen einen opiumartigen Geruch verbreiten. Es ist weniger giftig als das Nicotin.

2. Sauerstoffhaltige Alkaloide.

Opiumbasen. Morphin. E. Mylius bestimmt das Morphin im Opium colorimetrisch mittelst Jodsäure (Pharm. Centralh. IX. 97, X. 105.) Zum Nachweis des Morphins s. die Angaben von D. Vitali (L'Orosi 1881, S. 152; Ber. chem. Ges. 14, S. 1583.) Zur Constitution des Morphins: E. v. Gerichten und H. Schrötter (Ber. chem. Ges. 15, S. 376) und O. Hesse (ebend. 2260).

Codeïn. Ueber die Umwandlung des Morphins in Codeïn hat D. B. Dott (Pharm. Journ. trans. 1882, S. 1009) einige Mitteilungen gemacht. Die Eigenschaften von Grimaux's synthetischem Codeïn und Hesse's α- und β-Methylmorphin und des natürlichen Codeïns wurden so ähnlich gefunden, dass der Verf. die vier Substanzen für identisch hält.

Chinabasen. E. A. Maumené (Compt. rend. 94, 968) hat unter dem Titel „Synthese des Chinins" ein geschlossenes Schreiben an die Pariser Akademie gesandt mit der Angabe, dass darin eine einfache von ihm entdeckte Synthese des Chinins beschrieben sei, vor deren Veröffentlichung er noch eine Reihe von physiologischen Versuchen zur endgültigen Feststellung der Identität ausführen wolle.

C. Cameron (Chem. News 1882, 227) findet, dass das jodsaure und bromsaure Chinin stärker auf den Organismus wirke, als das Jodid und Bromid.

Hinsichtlich der quantitativen Bestimmung des Chinins hält J. E. de Vry (Pharm. Journ. trans. 1882, 601) im Gegensatz zu den Behauptungen von Christensen (Pharm. Zeitschr. Russl. 1881, p. 581) die von ihm vorgeschlagene Herapathitmethode mit einigen Modificationen aufrecht. Das von ihm angewandte Reagens wird dargestellt, indem man Chinoidin im Wasserbad mit 2 Teilen Benzol auszieht, die so erhaltene Lösung mit verdünnter Schwefelsäure schüttelt, die saure Flüssigkeit auf 2 Teile gelösten Chinoidins mit 1 Teil Jod und 2 Teilen Jodkalium unter fortdauerndem Rühren versetzt, den entstehenden Niederschlag durch Erwärmen zum Zusammenballen

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bringt, wäscht, im Wasserbade bis zum Entweichen des Wassers erwärmt und einen Teil des so erhaltenen Harzes mit 6 Teilen heissem Alkohol von 92 – 95 Proc. auszieht, den nach dem Erkalten vorhandenen Rückstand absondert, die alkoholische Lösung verdampft, den Rückstand in 5 Teilen kaltem Alkohol löst und filtrirt. Bei der Fällung der sauren Alkaloidlösung durch Jodlösung darf letztere nicht im Ueberschuss vorhanden sein, vielmehr muss die über dem Niederschlag stehende Flüssigkeit noch Basen enthalten. Mit dem so dargestellten Reagens werden Chininbestimmungen folgendermaassen ausgeführt. 1 g Chinin enthaltendes Alkaloidgemenge wird in 20 g Alkohol von 92—95 Proc. gelöst, welcher 1·5 Proc. Schwefelsäure enthält; 50 g Alkohol wird zugesetzt und sämtliches Chinin durch allmäligen Zusatz des Reagens mit der Vorsicht ausgefällt, dass sich das Reagens in mässigem Ueberschuss befindet. Letzteres ergiebt sich daraus, dass die über dem Niederschlag stehende Flüssigkeit gelb gefärbt ist. Der entstandene Niederschlag wird durch Erhitzen zum Kochen gelöst und nach 12 stündigem Stehen in der Kälte das Gewicht der gesamten Flüssigkeitsmenge bestimmt. Nachdem endlich der ausgeschiedene Herapathit gesammelt und mit alkoholischer Herapathitlösung gewaschen, nach dem Absaugen auf Filtrirpapier bei 100° getrocknet, gewogen und auf 100 Teile Mutterlauge um 0·125 g vermehrt ist (Löslichkeit des Herapathit bei 16°) wird er mit einem Gehalt von 55·055 Chinin in Rechnung gebracht.

Ueber die Prüfung von käuflichem Chininsulfat auf fremde Chinaalkaloide s. E. Kerner (Ber. chem. Ges. 14, S. 290; Arch. f. Pharm. 14, S. 438).

Weitere Mittheilungen über die Chinaalkaloide finden sich in den Arbeiten: O. Hesse, Gehalt der Chinarinden an Cinchonidin und Homocinchonidin (Ber. chem. Ges. 14, S. 1890). Ders., Eigenschaften und Krystallisation des schwefelsauren Cinchonidin (Ber. chem. Ges. 14, S. 45); Ders., Zur Geschichte der Cuprearinden (Ber. chem. Ges. 14, S. 58); H. Waidel und K. Hagura, Ueber das Cinchonin (Monatsh. f. Chem. 3, Sp. 770); Dies., Bestimmung des Cinchonidinsulfats im käuflichen Chininsulfat auf optischem Wege (Ber. chem. Ges. 14, S. 119); A. Claus, Zur Kenntnis des Cinchonidins (ib., Sp. 413); Ad. Skraup, Nichtexistenz des Homocinchonidins (ib., S. 1717); Ders., Entstehung der Chininsäure aus Chinin (ib., S. 2280).

Strychnosbasen. Hinsichtlich der Zusammensetzung des Strychnins haben A. Claus und R. Glassner (Ber. chem. Ges. 14, 773) gezeigt, dass die Analysen dieser Base Zahlen liefern, welche bald auf die Formel $C^{21}H^{22}N^2O^2$, bald auf die Formel $C^{22}H^{22}N^2O^2$ stimmen, die also für Strychnin aus verschiedenen Quellen verschieden sind.

Ueber Form und Zusammensetzung des Strychninsulfats siehe C. Rammelsberg (Ber. chem. Ges. 14, 1231).

Veratrumbasen. E. Bosseti, Studien über das officinelle Veratrin (Arch. Pharm. 1883, p. 82). Aus der Arbeit ergiebt sich, dass das officinelle Veratrin ein Gemisch zweier anscheinend isomerer Alkaloide von der Formel

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$C^{33}H^{49}NO^9$ ist, von welchen das eine krystallisirbar, das andere, das Veratridin, amorph ist. Ersteres zerfällt beim Kochen mit alkoholischem Baryumhydrat in Angelikasäure und eine amorphe, nicht zum Husten reizende Base, das Ceridin, das andere unter gleichen Bedingungen in Veratrumsäure und eine amorphe Base, das Veratroïn, welche ein weisses zum Husten reizendes Pulver darstellt.

Ueber die Entstehung der Veratrumsäure aus Hesperetinsäure durch Kaliumpermanganat, F. Tiemann und W. Will (Ber. chem. Ges. 14, 962).

Atropin. F. Buddel (Arch. Pharm. 17, 414) findet, dass in den Wurzeln der Atropa Belladonna ein geringerer Stärkemehlgehalt auch einen geringeren Atropingehalt bedingt. Im jüngeren Alter der Pflanze scheinen die Wurzeln nicht immer Stärkemehl zu enthalten, zuweilen sogar ganz frei davon zu sein.

Mit dem Atropin isomer ist das Hyoscyamin, welches nach den Angaben von A. Ladenburg und G. Meyer mit dem Daturin und Duboisin identisch ist. Das Duboisin ist ein seit kurzer Zeit im Handel vorkommendes Alkaloid aus einer australischen Pflanze *Duboisia myoporoides*. das stark mydriatisch wirkt und vorzugsweise zu ophtalmologischen Untersuchungen bei Personen verwendet wird, welche gegen Atropin zu empfindlich geworden sind (vgl. Gerrard, Journ. chem. Soc. 1878, 590).

In seinen Untersuchungen über Daturin giebt L. Pesci (Gar. chim. 1882, 59) an, dass aus 4 kg Stechapfelsamen nach einem genau beschriebenen Verfahren 1—9 g Daturin erhalten wurden.

Das in den Calabarbohnen, den Samen von *Physostigma venenosum*, vorkommende Alkaloid, Eserin, ist von O. Hesse (Ann. 129 u. 139) untersucht worden. Dasselbe ist höchst giftig und bewirkt starke Contraction der Pupille. Es dient unter anderem als Gegengift des Atropins und Belladonnins.

A. W. Gerrard hat das in der Wurzel von *Gelsemium sempervirens* vorkommende Alkaloid, Gelsemin, näher studirt (Pharm. Journ. 1883, 641). Die Wirkung auf das Auge ist nach J. Tweedy dem Atropin ähnlich, aber schwächer.

Caffein. Ueber die chemische Natur der im Thee, Kaffee und Cacao enthaltenen Alkaloide, des Theobromin's und Thein's s. E. Fischer (Ber. chem. Ges. 14, 637, 1912 und 15, 33); ferner E. Schmidt (Ber. chem. Ges. 14, 814), E. Schmidt und H. Pressler (Ann. 217), R. Maly und F. Hinteregger (Ber. chem. Ges. 14, 727, 893; 15, 1083).

Caffeïn zerfällt beim Kochen mit Barytwasser zunächst in Kohlensäure und Caffeïdin $C^7H^{12}NO^4$, eine Base, welche durch längeres Kochen in Ammoniak, Methylamin, Ameisensäure und Sarkosin (Methylglycocoll) gespalten wird. Durch Einwirkung von wässrigem Chlor zerfällt das Caffeïn in Dimethylalloxan und Methylharnstoff. Bei kräftigerer Einwirkung von Chlor entsteht Dimethylparabansäure. Durch Chromsäuremischung wird das Theïn in kohlensaures Ammoniak und Dimethylparabansäure zerlegt, während unter diesen Bedingungen aus Theobromin Methylparabansäure gebildet wird. Hiernach

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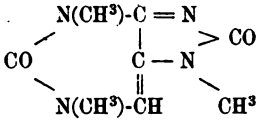
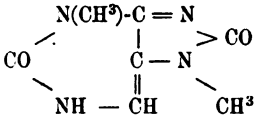
sind beide als Diureide der Mesoxalsäure aufzufassen, welchen aller Wahrscheinlichkeit nach die folgenden Structurformeln zukommen.



Thein.



Theobromin.

Xanthinblei geht bei Behandlung mit Jodmethyl nach E. Fischer in Theobromin (Dimethylxanthin) über, Theobrominsilber wird durch Jodmethyl in Thein übergeführt. Dem Xanthin nahe verwandt sind aber Guanin und Sarkin. Das erstere enthält an Stelle eines Harnstoffrestes im Xanthin den Guanidinrest, während Sarkin sich nur durch einen Mindergehalt von 1 Atom Sauerstoff von dem Xanthin unterscheidet und leicht mit Salpetersäure in letzteres umgewandelt werden kann. Hiernach sind die drei bisher nur als Producte des tierischen Stoffwechsels beobachteten Verbindungen Xanthin, Guanin und Sarkin analog constituirt wie die Pflanzenbasen Caffeïn und Theobromin, und es ist die Möglichkeit vorhanden, die Basen, welche die wirksamsten Bestandteile zweier wertvoller Genussmittel sind, aus einem ganz anderen Rohmaterial, nämlich dem Guano, darzustellen.

Fäulnisalkaloide oder Ptomaine. F. Selmi hat im Jahre 1873 zuerst auf die Gegenwart alkaloidähnlicher Substanzen in Leichen aufmerksam gemacht und seit dieser Zeit sind mehrere Arbeiten über diese „Ptomaine" ausgeführt worden. Nach dem Otto-Stas'schen Verfahren aus Cadaverbestandteilen oder faulenden Eiweisskörpern dargestellte Extracte lieferten mit den gebräuchlichen Alkaloidreagentien Reactionen, welche denen der Pflanzenalkaloide sehr ähnlich sind, und erwiesen sich grossenteils als Gifte für den lebenden Organismus. So haben Dupré (Ber. chem. Ges. **7**, 1491), Brugnatelli und Zenoni (Journ. de med. et chim. **28**, 41) und Corter (Dragendorff's J. B. 1878) in verschimmeltem Maismehl narkotisch und tetanisch wirkende Gifte gefunden, welche die Alkaloidreactionen zeigten. Schmiedeberg und Bergmann (Centr.-Blatt für die med. Wissensch. 1868, 615) gewannen eine ähnliche Substanz aus faulender Hefe und Zuelzer und Sonnenschein (Berl. klin. Wochenschr. 1869, 487) isolirten aus faulendem Fleisch eine dem Atropin ähnlich wirkende Substanz. Gautier und Etard (Compt. rend. **94**, 1298) fanden bei der Fäulnis von Albuminaten zwei nicht giftige Basen, welche sie als Parvolin und Hydrocollidin ansprachen und ebenso hat Béchamp (Compt. rend. **94**, 973) aus rohen Verdauungsgemischen solche nicht giftige Basen gewonnen. Auf diese Basen und ihre Bedeutung bei der gerichtlichen Analyse hat dann Th. Husemann (Arch. Pharm. 14, S. 359 und ebendas. 19, S. 415) mehrfach aufmerksam gemacht.

Aus neuerer Zeit sind die Arbeiten von A. Gautier und A. Etard (Compt. rend. **94**, 1357), L. Brieger (Zeitschr. f. phys. Chem. 7, Heft III. und Ber. chem. Ges. 16, S. 1186) und A. Poehl (Ber. chem. Ges. 16, S. 1975) zu erwähnen. Aus diesen Arbeiten scheint hervorzugehen, dass die giftigen

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Alkaloide Producte des ersten Stadiums der Fäulniszersetzung sind, die dann wieder verschwinden, wenn die Fäulnis weiter geht. Der Ptomainbildung geht Peptonisation der Eiweisskörper voran. (S. a. Hiller, die Lehre von der Fäulnis 1879, 76.) A. Poehl hat die Fäulnisalkaloide in dem faulenden Mehl bei Gelegenheit des Studiums über den Ergotismus untersucht und gefunden, dass die dem Mehl durch Aether extrahirbaren Substanzen in ihren Reactionen den Pflanzenalkaloiden ähnlich sind, aber kein optisches Rotationsvermögen zeigen. Als wesentliche Momente, welche die Bildung von Fäulnisalkoloiden im mutterkornhaltigen Roggenmehl bedingen, sind nach ihm anzunehmen: 1. Verwandlung der Stärke in Glycose, 2. Gährung der Glycose unter Bildung von Milchsäure, 3. Peptonisation der Eiweisskörper, 4. Uebergang der Peptone in Ptomopeptone und Zerfall derselben unter Bildung von Fäulnisalkoloiden.

L. Brieger hat gefunden, dass, sowie nach Schmiedeberg und Harnack das an und für sich ungiftige Neurin durch Oxydation in das äusserst giftige Muscarin übergeht, auch das Neurin als freie Base, in wässriger Lösung längere Zeit der Luft ausgesetzt, sich teilweise in giftige Producte verwandelt, die bei weiterer Zersetzung durch die Fäulnis wieder verschwinden. Aus frisch dargestelltem Pepton hat derselbe ebenfalls giftig wirkende Extracte gewonnen, deren Verhalten gegen die gewöhnlichen Alkaloidreagentien näher beschrieben ist. Charakteristisch ist das Verhalten gegen Millon's Reagens, welches einen weissen Niederschlag hervorruft, der beim Kochen intensi rot wird. Wenige Tropfen der wässrigen Lösungen zeigen intensiv giftige Wirkungen auf Frösche etc. Dieselbe toxische Substanz wird auch aus gefaulten Eiweisskörpern wie Fibrin, Casein, Gehirnsubstanz, Leber und Muskelfleisch erhalten. Also auch nach Brieger sind die Peptone die Ursprungsquelle dieser giftigen Substanzen. Nach einer kürzlich (Ber. chem. Ges. 16, S. 1186) gemachten Mitteilung hat derselbe aus faulenden Eiweisskörpern Ptomaine erhalten, die, wie auch schon Guareschi und A. Mosso (Arch. ital. de biolog. II., 367) angeben, eine dem Curare ähnliche Wirkung haben. Aus diesen hat er ein Diamin isolirt, welches dem Amylendiamin isomer ist. Dasselbe zeigt im reinen Zustande nur schwach toxische Wirkungen. Aus den Mutterlaugen dieser Base hat er dann ein zweites Alkaloid erhalten, welches ein Isomeres des Piperidins zu sein scheint. Es zeigt äusserst giftige Wirkungen und zwar unter Erscheinungen, welche öfters bei Fischvergiftungen beobachtet wurden. Möglicherweise sind nach der Ansicht des Verf. solche toxisch wirkenden Substanzen die Ursache, weshalb bei einer grossen Anzahl von Infections- und Darmkrankheiten der Tod oft ganz plötzlich eintritt.

Ueber aus dem Harn dargestellte giftige Alkaloide siehe Gautier (Journ. de l'anatomie et physiol. 17, 333) und Balduino Bocci (Centralbl. f. d. med. Wissensch. 1882, No. 51).

F. Coppola hat aus frischem Blut solche Alkaloidextracte erhalten und ist der Ansicht, dass auch im circulirenden Blut eine Bildung von Pto-

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mainen aus Eiweiss erfolgt. Aehnliches fanden Paterno und Spica (Garz. chim. 1882, 63).

Ueber die Reactionen der Ptomaine siehe die Arbeiten von Brouardel und Boutmy (Compt. rend. 92, 1056), P. Spica (Gazz. chim. 11, 486) und Dragendorff (Pharm. Zeitschr. russ. 1882, 512). W. Will.

XXXVIII. Apparate.

1. Zerkleinerungsapparate.

In der Farbenreibmaschine von Schlager in Ybbs, Niederösterreich, (D. P. 18952.) werden die Farben in einem hermetisch abgedichteten Gefäss gerieben. Eine Luftpumpe oder eine Luftcompressionsmaschine drückt in eine oder gleichzeitig in mehrere Farbenreibmaschinen, deren Farbenbehälter *A* durch einen Deckel *B* hermetisch geschlossen sind, Luft ein. Ein solcher hermetisch schliessender Deckel *B* ist mit einem Rohransatz *d* versehen, in welchem die Ventile *f* und *g* angeordnet sind. (Fig. 296.)

Fig. 296.

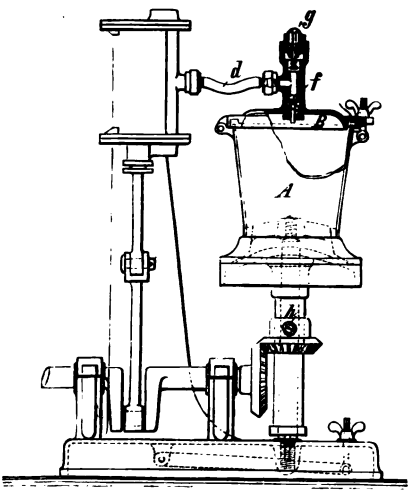
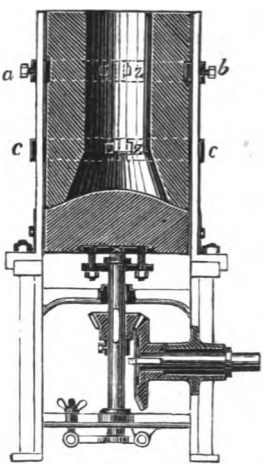


Fig. 297.



J. W. Trautmann in Breslau befestigt den Oberstein an seiner unterläufigen Farbmühle, deren Steine aus klarem, durchsichtigem Glase, gefrittetem Porcellan oder natürlichem dichten Gestein, wie Achat, festem Granit etc., hergestellt sein können, durch den dargestellten zweiteiligen Ring mit Oesen und Schrauben *ab* an Führungsschienen, in Verbindung mit dem Ring *c* und den Schrauben *z*. (D. P. 20094, Fig. 297.)

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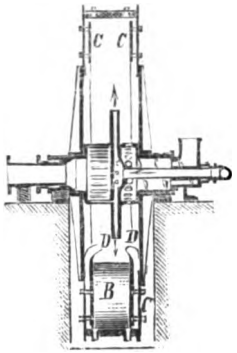
Fig. 298.

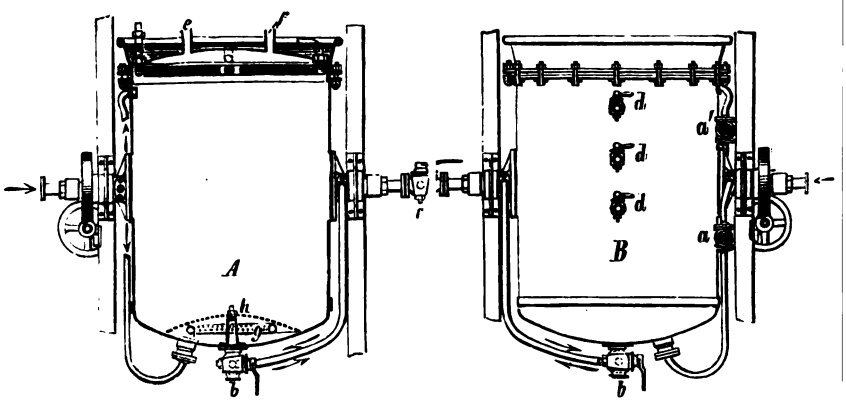


M. Neuerburg in Köln bringt in der Trommel seiner Cylindermühle (D. P. 19456 vom 17. Januar 1881) Zwischenwände *C* an, welche dem Kollerstein *B* zur Führung dienen und es ermöglichen, dass das Mahlgut unter dem Kollerstein *B* seitlich ausweichen und bei der Drehung der Trommel wieder durch Schienen *D* der Mahlbahn zugeführt werden kann.

2. Extractionsapparate.

Der Extractionsapparat von Volkmar Hänig und Otto Reinhard in Dresden*) ist jetzt folgendermaassen eingerichtet. Es sind zwei mit einander verbundene Apparate *A* und *B* angeordnet. Wenn dieselben mit Material gefüllt sind, wird durch den Dreiweghahn *c* und den Dreiweghahn *b* eine verhältnismässig geringe Menge heisses Wasser in den Apparat *A* gelassen und durch Ventil *a* und das durchlöcherte Schlangenrohr *g* dem Apparat Dampf zugeführt. Die sich entwickelnden Dämpfe durchdringen das weiter

Fig. 299.



oben liegende Material, werden am Rückflusskühler condensirt und tropfen durch das Material zurück, die oberen Schichten desselben auslaugend. Um die Auslaugung dieser oberen Materialschichten zu beschleunigen, kann man durch Ventil *a'* noch etwas directen Dampf in diese treten lassen, welcher ebenfalls am Rückflusskühler condensirt wird. Hat man auf diese Weise einen oder zwei starke Absude gewonnen, welche durch die Dreiweghähne *b* und *c* mittelst Dampfdrucks nach einem Behälter befördert werden, so werden die später resultirenden dünneren Lösungen mittelst Dampfdrucks durch die

*) Techn.-chem. Jahrb. 1883, S. 367.

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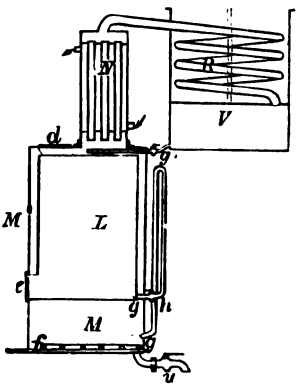
Dreiweghähne *b* und *c* nach Apparat *B* befördert, wo sie zur Extraction von frischem Material dienen. Apparat *A* wird nun entleert und frisch gefüllt, und ist nun *B* erster und *A* zweiter Apparat und so fort. *dd* sind Probirhuber, bei *e* und *f* sind Luft- und Sicherheitsventile angebracht. (D. P. 18922.)

Josef Merz in Tarnow. Extractions-Apparat. (D. P. 20747.) In dem Behälter *M*, auf dessen Boden sich eine Dampfschlange *f* befindet, ist das Gefäss *L* angeordnet. Dies wird durch das Mannloch *d* mit der zu extrahirenden Substanz beschickt. Aus dem Reservoir *V* lässt man nun das Lösungsmittel einfliessen. Sobald dessen Niveau die Höhe g^1 überschreitet, wird es durch das Heberrohr gg^1g nach *M* geführt und hier verddmpft. Die Dämpfe erwärmen das Gefäss *L*, gelangen nach dem Kühler *N*, von wo die condensirte Flüssigkeit nach *L* zurück fliesst, um nach Erreichung der Höhe *g'* von hier wieder nach *M* gezogen zu werden. Zeigt eine bei *h* gegenommene Probe, dass die Extraction beendet ist, so wird das Kühlwasser von *N* abgestellt, die Dämpfe gelangen nach dem Kühler *R* und die Flüssigkeit sammelt sich im Behälter *V*. Das Extract wird bei *u* abgezogen, das Extractionsgefäss *L* bei *e* entleert. Wenn *L* zum Teil mit Knochenkohle oder dgl. beschickt wird, kann der Apparat auch zum Entfärben dienen.

Fig. 300.



Edward B. Hart in Belfast. (D. P. 19185.) Das Extractionsgefäss, Fig. 301 folg. S., ist durch eine Filterplatte *b* in die obere Kammer *a* und die untere *a'* geteilt. Das Gefäss ist durch den doppelwandigen auf der unteren Seite gerauhten Deckel *c* geschlossen. Die Räume *a* und *a'* stehen durch das seitlich angebrachte, mit einem Ventil *e* versehene Rohr *d* (Fig. 302) mit einander in Verbindung. Durch das Rohr *l* tritt aus den Behältern *o* und *o'* das Extractionsmittel in den Raum *a'*, während Dampf aus dem Rohr *s* durch den Mantel des Apparates strömt. Nachdem die Luft aus dem Apparat durch Rohr *i* entwichen ist, werden die Hähne *m* und *n*, sowie das Ventil *e* geschlossen. Durch den doppelwandigen Deckel *c* lässt man dann Kühlwasser fliessen. Der Dampf des Lösungsmittels geht durch das auf dem Filter *b* gelagerte zu extrahirende Material und wird am Deckel *c* condensirt. Wegen des geringen Ueberdrucks im Raum *a'* fliesst die condensirte Flüssigkeit aber nicht nach *a'* zurück, sondern wird in dem Material auf dem Filter *b* im Kochen erhalten. Nach vollendeter Extraction wird das Ventil *e* geöffnet, der Druck gleicht sich aus und die Lösung fliesst nach *a'*. Durch Anwendung des Probirhahns *g* kann man den Grad der Extraction prüfen. Nachdem das Material ausgewaschen ist, wird das Rohr *d* wieder geschlossen, der Hahn *n* im Rohre *l* geöffnet und

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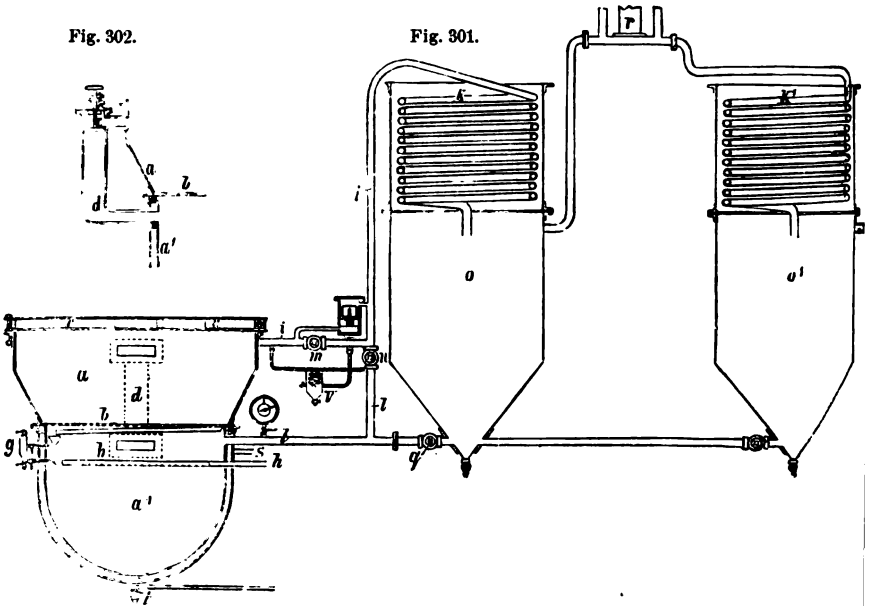
durch den Deckel *c* anstatt Wassers Dampf geleitet. Zugleich wird die Pumpe *r* in Gang gesetzt. Der Dampf des Lösungsmittels wird in den Kühl-

Fig. 302.

Fig. 301.



schlangen *k* und *k'* condensirt und die Flüssigkeit sammelt sich in den Behältern *o* und *o'*. Das Extract wird durch den Hahn *t* abgezogen. Nachdem das Lösungsmittel aus dem Raum *a'* verdampft ist, wird der Hahn *n* geschlossen und *m* geöffnet. Wenn durch Wirkung der Pumpe *r* ein genügendes Vacuum entstanden ist, wird durch das Rohr *h* ein wenig Dampf in *a'* eingelassen, dessen Menge das Vacuum nicht wesentlich verringert. Dieser Dampf zieht das Lösungsmittel aus dem auf dem Filter *b* liegenden erschöpften Material und wird mit diesem in *k* condensirt. Sobald der Probirhahn *v* nur noch Wasser liefert, ist die Operation beendet.

3. Koch- und Verdampfapparate.

E. A. Lentz in Berlin bringt bei Dampfkochapparaten für chemische Laboratorien (D. P. 19038) an dem Dichtungsring der Gefässe, welche in die Oeffnungen der den Dampfraum bedeckenden Deckplatte gesetzt werden, Stifte an, welche in entsprechende Rinnen der Deckplattenwand eingreifen, so dass durch Drehen des Gefässes dasselbe sicher genug befestigt werden kann, um durch den Druck gespannten Dampfes nicht aus seiner Lage gebracht zu werden.

Im Apparat von Gontard in Mockau sind Scheiben von gut Wärme leitendem Material in einem bis zur Hälfte mit Flüssigkeit gefüllten Gefäss

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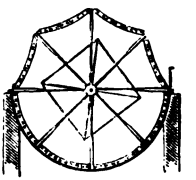
auf einer rotirenden Welle aufgekeilt. Die Scheiben sind bis in die Mitte aufgeschnitten und seitlich auseinandergezogen, so dass jede Scheibe einen Schraubengang bildet.

Zum Loslösen, Forttransportiren und Herauswerfen der beim Abdampfen von Laugen etc. an die Pfanne sich ansetzenden Krystalle dienen in der Abdampfpfanne von Tedesco in Mügeln (D. P. 19974). zwei Sperrketten, welche an den Enden der Arme des Rührwerks in Schraubenlinien locker aufgehängt sind, so dass der Pfannenboden bei jedesmaliger Umdrehung des Rührwerks durch die Ketten bestrichen wird. Diese Anordnung bewirkt, dass die Salze an das eine Ende der Pfanne transportirt und durch eine Oeffnung am Pfannenende hinausgeworfen werden.

Fig. 303.



Im Apparat von F. Courtois und van Roy in Brüssel (D. P. 20393) tritt die Flüssigkeit durch Rohr T in das unterste Schlangenrohr S ein, steigt in den übrigen Schlangenrohren in die Höhe und fällt durch Rohr T^1 auf die versetzt über einander angeordneten Platten p. Zwischen diesen hindurch und um die Schlangenrohre S herum wird mittelst des Ventilators E fortwährend ein im Feuerraum A erhitzter Luftstrom gesaugt. Im Gefäss G sammelt sich das Product, in G^1 die durch den Luftstrom mitgerissenen Teile.

Fig. 304.

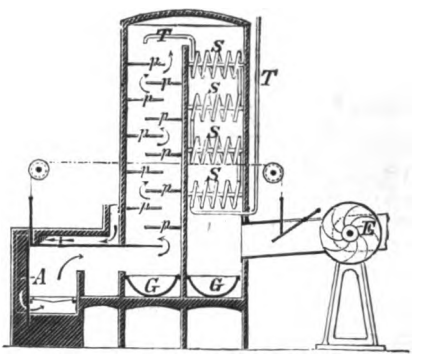
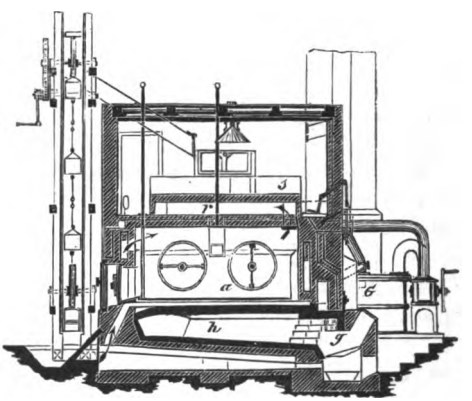


Fig. 305.



Swiecianowski und Adamczewski in Warschau haben ihren Abdampf-Ofen*) verbessert (D. P. 20392). Das in einer geschlossenen Kammer angeordnete Abdampfgefäss a besitzt die Canalheizung h. Die Verdampfung wird durch erhitzte Luft begünstigt, welche in den Abdampfraum geleitet wird. Die Erhitzung derselben erfolgt durch ein Röhrensystem, welches auf dem den

*) Techn.-chem. Jahrb. 1883, S. 371.

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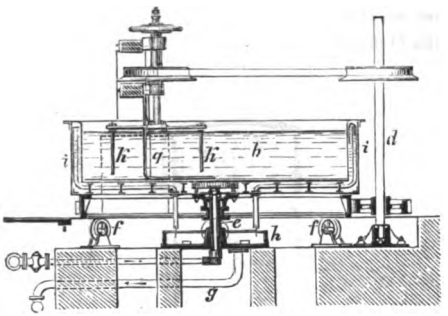
Canal *h* abdeckenden Gewölbe angeordnet ist. Ein zweites, neben diesem liegendes Röhrensystem dient zum Erhitzen der für den Trockenraum bestimmten Luft. Die in den Abdampfraum gelangte erhitzte Luft vermischt sich mit den beim Abdampfen entweichenden Dämpfen und wird durch den Canal *r* geleitet, der unterhalb der Trockenpfanne *s* angeordnet ist. Von hier gelangen die Gase entweder in den Schornstein, in die Feuerung *g* oder in das Wasch- oder Absorptionsgefäss *G*.

Philippi in Hamburg hat einen Apparat zur Erzeugung feinkörniger Krystallisationen durch Abkühlen und Erschüttern der Laugen angegeben (D. P. 20983). Der doppelwandige Bottich *b* kann um seine Mittelachse *e* rotiren. Derselbe ist mit einem excentrisch angebrachten und von derselben Transmission *d*, von der auch der Bottich seinen Antrieb erhält, getriebenen Rührwerk *k* und festsitzenden Schabern *g* versehen, welche ein Ansetzen des Krystallmehls an dem Boden und den Wandungen des Bottichs verhindern. Der Bottich rotirt auf kleinen Rollen *f*, welche eine dauernde leichte Vibration desselben hervorrufen und dadurch zur Erzeugung eines feinen Krystallmehles beitragen. In die doppelten Wandungen strömt von unten her durch die Hohlachse *e* Kühlwasser ein, welches durch die Ueberfallrohre *i* nach dem um die Achse angeordneten Reservoir *h* und von dort durch das Rohr *g* abfliesst.

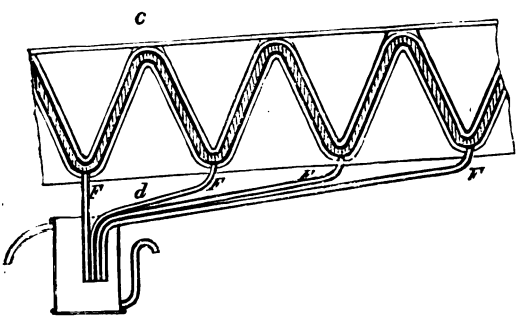
Fig. 306.



4. Destillation und Absorption.

C. Lührig in Dresden. Apparat zur fractionirten Condensation gemischter Dämpfe. (D. P. 20679.) In dem zickzackförmigen Canal werden die zu condensirenden Dämpfe dem Laufe des Kühlwassers entgegen geleitet. Die condensirten Flüssigkeiten werden durch Rohre *F* abgeleitet.

Fig. 307.



Th. Oppler in Doos bei Nürnberg (D. P. 19591) stellt Briquettes her, welche, in Canälen oder Kammern auf-

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geschichtet, zur Bindung gas- oder dampfförmiger Säuren dienen sollen. Dieselben bestehen aus einer Mischung von Alkalien, alkalischen Erden, Salzen mit porösen Substanzen, Kohle, Coks, Sägemehl und dergleichen und Klebmitteln (Leim, Stärke, Dextrin, Wasserglas etc.).

5. Filter und Filterpressen.

Filtrirmaterial von Owen Bowen in London (Engl. P. 2086 vom 3. Mai 1882) wird durch Vercokung von Cannelkohle, welche mit Thon vermischt ist, erhalten.

Gottschalk & Co. in Cassel stellen Filterpresstücher aus einem Gewebe her, welches in der Kette aus Metall- und im Schuss aus Asbestfäden gefertigt ist. (D. P. 21517.)

Nach D. P. 20122 von Vollmar in Kempten, Rheinpreussen, sind in den Cylinder *ABCD* die Filterelemente *E* so eingesetzt, dass sie mittelst eines Zinntrichters genau in die im Boden *b* befindlichen Düsen passen. Die in der Mitte der Vorrichtung befindliche Stange *c* trägt oben eine Schraube, welche eine Platte gegen die Filter drückt. Die Filterelemente bestehen aus einem massiven Holzcylinder, der mit Längsrinnen versehen ist. Ueber denselben wird die Filterschicht *d*, eine zwischen weitmaschige Tuchstreifen gepresste Schicht von Papiermasse, oben und unten (bei *f*) festgebunden. Die zu filtrirende Flüssigkeit tritt bei *B* in den Apparat. Das Filtrat dringt in die Hohlkehlen *c* und gelangt, wie Fig. 308 zeigt, in den Sammelkasten *C*, ohne dass die atmosphärische Luft damit in Berührung kommen kann.

Fig. 308.

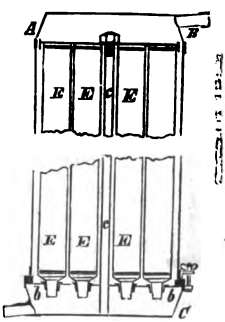
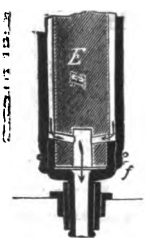


Fig. 309.



Um eine Reinigung des Filtrirmaterials vornehmen zu können, ist an dem Filtrirapparat von Piepke in Berlin*) ein mit Schabern versehener Kurbelmechanismus angebracht, welcher ein Aufrühren des verschmutzten Filtrirmaterials gestattet, während ein gleichzeitig zugelassener starker Wasserstrom den Schmutz durch die nun freigewordenen Siebe hindurchschwemmt. Nach vollendeter Reinigung stellt man das Drehen des Kurbelmechanismus ein, und das in jeder Kammer suspendirt gehaltene Filtrirmaterial sinkt auf die Siebfläche zurück. Durch Oeffnen eines Hahnes am unteren Ende des Apparates kann das unbrauchbar gewordene Filtrirmaterial von dem ausströmenden Wasser mit abgeführt werden, ohne dass der Apparat aus einander genommen zu werden braucht. (D. P. 21702.)

An dem Handfiltrirapparat von Oldham und Farguhar in London (D. P. 21976) ist *A* die Filtrirkammer, *B* eine mit einem Flanellsack über-

*) Techn.-chem. Jahrb. 1883, S. 380.

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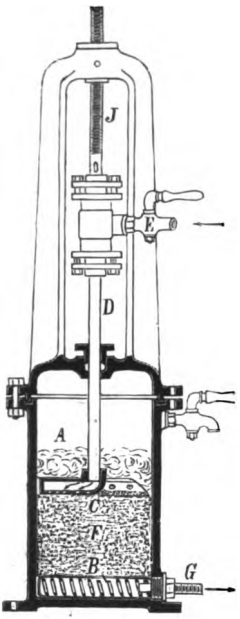
zogene Spiralfeder aus verzinntem Metalldraht, auf welcher das gewöhnlich aus Sägespänen bestehende Filterbett *F* ruht. *C* ist eine Platte mit Schaber zur Reinigung der Oberfläche des Filterbettes von den sich aus der Flüssigkeit ablagernden Teilen behufs Beschleunigung der Filtration, *D* die hohle Achse der Platte, durch welche die bei *E* eintretende Flüssigkeit in die Filterkammer gelangt. Durch Drehen der Schraube *J* kann man die Platte *C* bei Verminderung des Abflusses der filtrirten Flüssigkeit aus *G* niederbewegen, um die Oberfläche des Filterbettes zu reinigen. Wegen des Abschlusses der Luft bei der Filtration eignet sich dieselbe auch für Flüssigkeiten, welche an der Luft durch Oxydation leiden, z. B. Weine.

Fig. 310.



Um die Metalltücher seiner Filterpresse*) zu schonen, legt G. Hövelmann in Barmen zwischen diese und die mit Canälen versehenen Pressplatten Filterbleche. (D. P. 20037.)

Krooo in Halle dichtet die Canäle an Filterpressen durch Gummi-Dichtungsringe ab, indem die in den Platten und Rahmen der Filterpresse befindlichen Oeffnungen, welche an einander gereiht die Canäle bilden, abwechselnd gross und klein hergestellt und die grossen Oeffnungen mit den Gummiringen ausgekleidet werden. An beiden Enden stehen die Ringe so viel vor, dass ihre Endflächen in geschlossenem Zustande der Filterpresse auf die benachbarten abzudichtenden Flächen stossen. (D. P. 22796.)

Wohanka & Co. in Wien. Vorrichtung zur Selbstregulirung des Zuflusses von Pressgut bei Filterpressen, die mit Pumpen betrieben werden. (D. P. 20776.)

O. Müller in Neuschönefeld bei Leipzig. Verschluss für Filterpressen. (D. P. 22720.) Die Spindel der Presse ist in einer seitlich verschiebbaren Mutter gelagert. Behufs Oeffnens der Filterpresse wird diese Spindel aus der Vertiefung des an der Kopfplatte befindlichen Ansatzes *a* geschraubt und samt Mutter seitlich zwischen zwei Schienen *b* verschoben. Fig. 311.

Fig. 311.

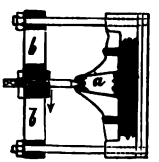
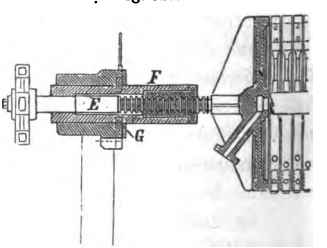


Fig. 312.



Die Verschlussvorrichtung von Joh. Fritsche in Magdeburg (Fig. 312) be-

*) Techn.-chem. Jahrb. 1883, S. 383.

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steht in einer Schraubenspindel *E*, deren Mutter *F* bei Schluss der Presse durch den rahmenförmigen, mit Handhebel verschiebbaren Riegel *G* gehalten und behufs Entleerung der Presse nach Lösung der Schraubenspindel *E* und Zurückschiebung des Riegels *G* so weit aus dem Kopfstück herausgezogen wird, dass die Pressplatten auseinander geschoben werden können. (D. P. 17337.)

6. Trockenapparate.

W. Kübel in Stassfurt. Apparat zum Trocknen von Körpern sowie zur Absorption von Gasen. (D. P. 19920.) In ein vertical stehendes Rohr aus feuerfestem Material sind in gleichmässigen Abständen den Querschnitt des Rohres ausfüllende drehbare Roste eingesetzt. Das Rohr ist derart von Mauerwerk umgeben, dass ein schneckenförmiger Zug für die Heizgase gebildet wird. Das zu behandelnde Material wird auf den obersten Rost gegeben und durch Drehen desselben auf den nächstunteren befördert, von welchem es in gleicher Weise den folgenden Rosten zugeführt wird, bis es unten getrocknet den Apparat verlässt.

Oscar Schimmel in Chemnitz. Verticale Kastentrockenmaschine. (D. P. 18926.) Während die mit Trockengut gefüllten Kästen von oben nach unten bewegt werden, ist der Durchzug der zum Trocknen dienenden Luft ein schlangenförmiger, indem dieselbe unten bei *g* eintritt und in der Richtung der Pfeile die oberen und unteren Flächen der verschiedenen Schichten *s*, abwechselnd einmal von rechts, einmal von links bestreicht. Um dies zu erreichen, sind die Trockenkästen bei *o* und *p* seitlich offen und nur mit einem Geflecht versehen, damit loses Material nicht mit fortgenommen werden kann. Durch luftdichte Zwischenlagen *r* von der Höhe eines Kastens wird ein Luftgegenstrom in einem und demselben Kasten verhindert. Fig. 313.

Fig. 313.

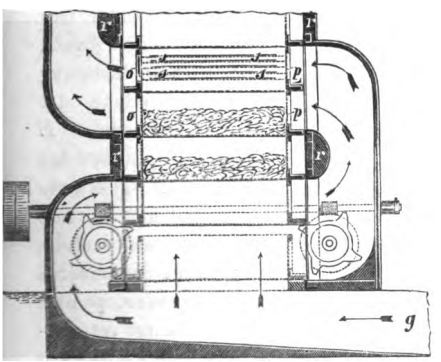
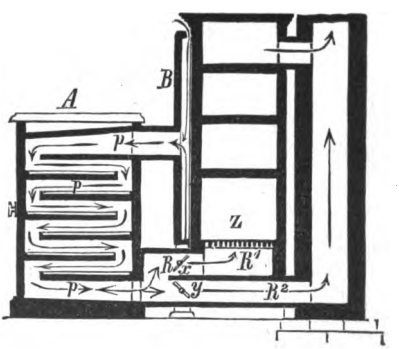


Fig. 314.



A. Wünsche in Meissen. Trockenapparat. (D. P. 19919, Fig. 314.) In einem Kasten *A* bildet eine Anzahl voller Trockenböden, an beiden Seiten an die Wände anschliessend, einen durch die Pfeile *p* angedeuteten Zug für Durch-

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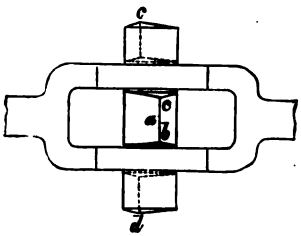
gang von Luft. Der Zug beginnt in einer Oeffnung oben im Schirme *B*, der gegen eine Heizfläche des Ofens gekehrt ist; das Ende des Zuges steht bei *f* in Verbindung mit einem Rohr *R*, das sich in R^1 und R^2 mit den Klappen *x* und *y* verzweigt. R^1 mündet unter den Aschenraum, R^2 in den Schornstein. Beim Anfeuern sind *x* und *y* geschlossen, darauf werden die Ofentüren geschlossen und *x* geöffnet. Der Schornstein saugt dann die Luft durch den angegebenen Zug; das Absaugen kann noch durch Oeffnen von *y* verstärkt werden.

7. Waagen.

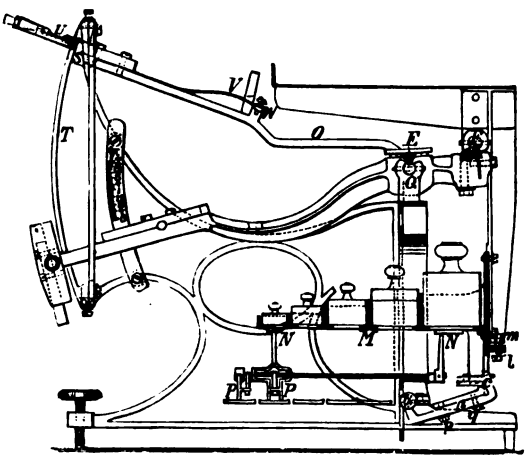
Fig. 315.



H. Bochhacker in Berlin stellt das als Schneide dienende Prisma *a* gekröpft her mit gegen einander versetzten Schneiden. Die Auflage-Schneidenlinie *cd* und die Lastgehänge-Schneidenlinie *be* können, bei gleicher Höhenlage, in beliebig nahen Abstand gebracht werden. (D. P. 21471.)

Julius Post in Hamburg. Neuerungen an Waagen. (D. P. 20693.) Behufs Parallelführung des Gehänges belasten Wägeobject und Gewichte nur die eine Seite immer unter constantem Druck, da für das Wägeobject entsprechende Gewichte abgenommen werden. Es genügt deshalb die einfache Verbindung des unteren Gestängeteiles mit dem feststehenden Lagerbrett durch ein in Schneiden *b* und *c* ruhendes Gelenk *a*. Zum Zweck der leichten Justirung und Einstellung der Achsenschneiden *E* und *F* besteht das Gehänge, gleichwie das Gelenk *a*, aus zwei Teilen, welche durch die Schrauben *l* und *m* bezw. *p* und *q* zu einander verschoben werden können. Zur beliebigen Arretirung des Waagebalkens dient der um die Mittelachse *Q* drehbare ein- oder zweiarmige Hebel *O*, welcher sich mit einem Winkel durch die an letzterem angebrachten Führungsleisten *S* an dem Bogen *T* führt und mittelst des federnden, in entspre-

Fig. 316.



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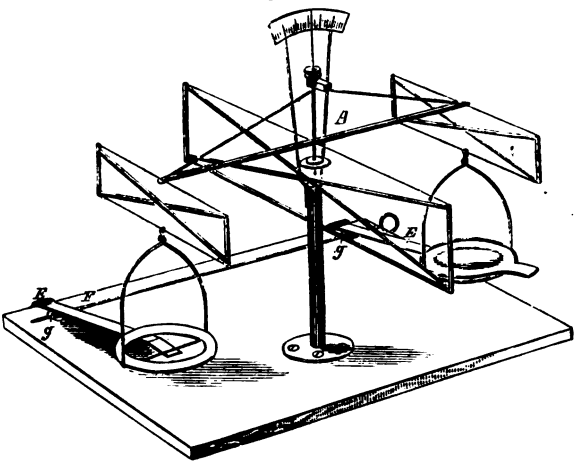
chende Löcher des Bogens eingreifenden Bolzens *U* festgestellt werden kann. Der Hebel *O* trägt die Feder *V*, deren Stellschraube *W* sich auf den Wagebalken stützt, so dass sich letzterer gegen die Feder *V* drücken kann, wenn sich der Arretirungsarm in seiner untersten Lage befindet. Die Gewichte werden auf einen mit dem Gehänge fest verbundenen Rahmen *M* in einzelne Abteilungen gestellt, die nur für das eine bestimmte Gewicht Raum bieten, für kleinere aber in Folge Durchlochung des Bodens keine Unterstützung gewähren. Beim Entfernen der Gewichte aus den Abteilungen werden dieselben auf die Hebel *P* gesetzt, welche zur Unterstützung der Gewichte bei *N* angreifen.

Fig. 317.



Roeder und Springer in Cincinnati, V. S. A. benutzen an Stelle von Zapfen oder Schneiden und Pfannen Drähte, welche, zwischen Rahmen ausgespannt, als Aufhängeteile dienen. Die Arretirung der Waage wird durch Drehung einer mit Excentern *g* versehenen Welle *F* und dadurch hervorgebrachtem Heben der Federn *E* bewirkt. (D. P. 21442.)

8. Thermometer und Pyrometer.

Ein Thermometer von Paul Schoop in Biebrich a. Rh. (D. P. 20345 vom 4. Februar 1882) soll hauptsächlich die Wärme des bei Hochöfen angewendeten Gebläsewindes messen und besteht aus einem von dem Gebläsewind umspülten Gefäss und einem Bourdon-Manometer, welches durch eine Capillarleitung mit dem Gefäss in Verbindung steht und sich in dem Arbeitsraum des Aufsichtsbeamten befindet. Das Gefäss ist mit einem trockenen Gas (Luft, Stickstoff u. dgl.), und die Manometerröhre mit einer Flüssigkeit von möglichst geringer Tension (Glycerin, Oel) gefüllt. Der Druck im Gefässe, welcher der Temperatur des umgebenden Mediums entspricht, bewirkt eine Gestaltsveränderung der Manometerröhre. Diese steht durch geeignete Hebelübersetzung mit einem Zeiger in Verbindung, welcher die Temperatur des Gebläsewindes angiebt.

Moritz Immisch in London (D. P. 19785 vom 16. Juli 1881) füllt den

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Raum des Gehäuses *L*, welcher die luftleere oder mit ausdehnbarer Flüssigkeit gefüllte Bourdon'sche Röhre *A* umgiebt, mit dehnbaren und Wärme absorbirenden Dämpfen an. Die von diesen veranlasste Ausdehnung und Zusammenziehung von *A* bewirkt die Bewegung des Zeigers *D* mittelst eines Zahnsectors, welcher in ein auf der Zeigerachse befestigtes Triebrad *C* eingreift. Der Zeiger *D* wird festgestellt oder gelöst durch Drehung des Excenters *N*, indem dieses die Feder *O*, welche die Zeigerachse trägt, nach unten drückt bezw. aus dieser gespannten Lage befreit.

Fig. 318.

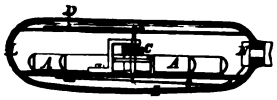
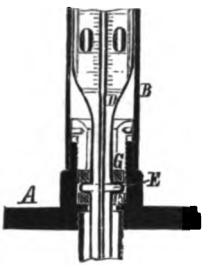
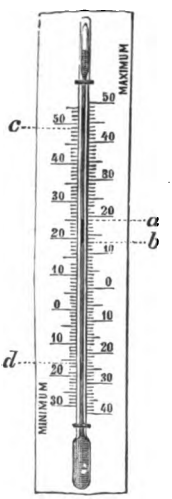


Fig. 319.



Um Glasthermometer, welche von einer Metallhülse *B* umgeben werden, bei Bruch leicht auswechseln zu können, bringt Fr. Rassmus in Magdeburg an dem Glaseinsatz *D* den Bund *E* an. Der Oberteil *B* der Metallhülse lässt sich von dem Unterteil *A* abschrauben. Der Bund *E* wird zwischen zwei Kautschukringe *F* und *G* gelegt, welche durch Einschrauben der doppelteiligen Mutter *H* in *A* den Bund *E* fest umfassen. Dann wird wieder Rohr *B* aufgeschraubt (D. P. 18824).

Fig. 320.



Heinrich Kappeller in Wien hat das Six'sche Maximum- und Minimumthermometer dahin abgeändert, dass statt der mehrfach gebogenen eine einzige gerade Glasröhre gewählt ist, die so weit mit Alkohol gefüllt ist, dass die obere Erweiterung etwa noch zur Hälfte gefüllt ist. An einer passenden Stelle des Capillarrohres ist die Continuität der Weingeistsäule durch einen kurzen Quecksilberfaden *a b* (5 bis 6° lang) unterbrochen, welcher sich beim Steigen der Temperatur nach oben, beim Fallen nach unten bewegt, also als Indicator der eben existirenden Temperatur dient. Unterhalb des Quecksilberfadens befindet sich ein Stahlindex *d*, oberhalb ein zweiter Index *c*. Beide Indexe werden von dem Quecksilberfaden in Bewegung gesetzt, der obere wird so lange fortgeschoben, als die Temperatur im Steigen begriffen ist und dann am höchsten Stande zurückgelassen; das Umgekehrte findet statt beim zweiten Index *d*. Zum Ablesen der Extreme der Temperatur dienen zwei Scalen, welche in demselben Sinne von unten nach oben laufend, nur um die Länge des Quecksilberfadens versetzt sind. Mittelst eines Magnetes werden die Indexe wieder eingestellt (D. P. 21082).

J. C. Schloesser in Königsberg bringt an Medicinalthermometern zwischen dem Null- und 100°-Punkt Erweiterungen *P* und P^1 der Quecksilberröhre an. Dadurch wird es ermöglicht, an ärztlichen Thermometern, deren Scala bisher nur wenige Grade, etwa von 33 bis 45° umfasst, auch den 0°-Punkt und

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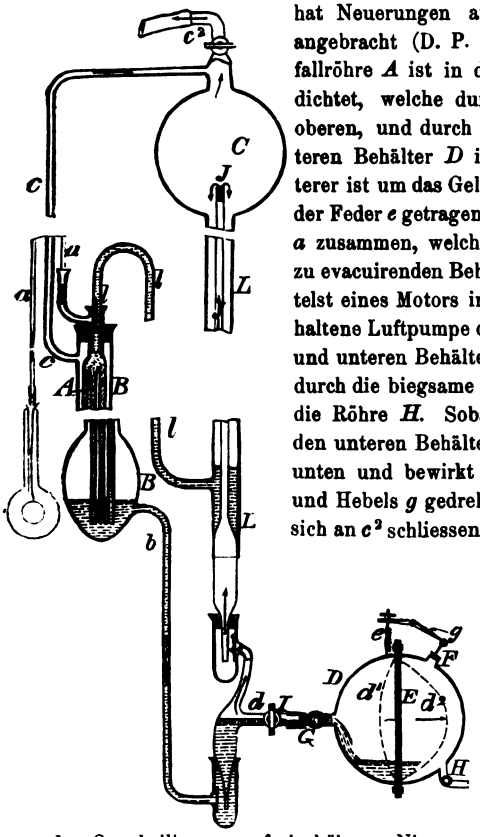
den 100°-Punkt anzubringen, ohne die Ausdehnung des Scalenteiles 33 bis 45° zu verringern und ohne den Thermometern eine unbequeme Länge zu geben. Zugleich gestattet das Vorhandensein des Null- und Siedepunktes, die für die mit der Zeit etwa eingetretene Verschiebung des Nullpunktes erforderliche Correctur der Scalenablesung zu bestimmen (D. P. 21062 vom 18. Juni 1882, Fig. 321.)

Fig. 321.

9. Luftpumpen und Barometer.

Fig. 322.



Ch. H. Stearn in New-Castle upon Tyne hat Neuerungen an Quecksilber-Luftpumpen angebracht (D. P. 20999). Die Quecksilberfallröhre *A* ist in die äussere Röhre *B* eingedichtet, welche durch die Röhre *c* mit dem oberen, und durch die Röhren *b d* mit dem unteren Behälter *D* in Verbindung steht. Letzterer ist um das Gelenk *G* drehbar und wird von der Feder *e* getragen. Mit *A* hängt die Saugröhre *a* zusammen, welche an ihrem freien Ende den zu evacuirenden Behälter a^1 trägt. Je eine mittelst eines Motors in beständiger Bewegung erhaltene Luftpumpe communicirt mit dem oberen und unteren Behälter und zwar mit dem oberen durch die biegsame Röhre c^2, mit dem unteren durch die Röhre *H*. Sobald nun genügend Quecksilber in den unteren Behälter *D* gelangt ist, geht dieser nach unten und bewirkt das Oeffnen des mittelst Feder *e* und Hebels *g* gedrehten Ventils *F*. Hierauf saugt die sich an c^2 schliessende Luftpumpe die Luft aus *C*, *B*, a^1 und ihren Communicationsröhren teilweise heraus. Oeffnet man jetzt den Hahn *I*, so bläht die durch *F* eindringende Luft das den Behälter *D* in die Abteilungen d^1 d^2 zerlegende Diaphragmen *E* nach links und treibt das Quecksilber durch die Röhren *d* und *J* nach *C*, von wo es durch die Röhren *L* und *l* nach *A* gelangt. Während das Quecksilber so auf ein höheres Niveau gelangt, nimmt das Gewicht von *D* ab, die Feder *e* erlangt das Uebergewicht und verhindert durch Schliessung von *F* den weiteren Luftzutritt. Ist *D* von Quecksilber leer, so öffnet man den Hahn der Röhre *H*, so dass die an diese sich anschliessende Luftpumpe die Abteilung d^2 leer saugt. Infolge dessen bläht sich *E* in Richtung nach

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rechts, das Quecksilber fliesst aus *B* durch *b* und *d* nach dem Behälter *D*, bis dieser sinkt und das beschriebene Spiel von neuem beginnt.

Clerc und Hémot in Paris haben folgende Neuerung an der Geissler-

Fig. 323.

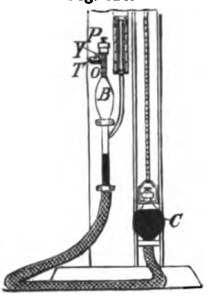
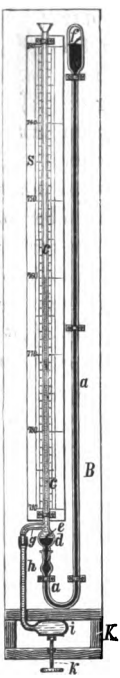


Fig. 324.

schen Luftpumpe angebracht (D. P. 21050). Das Schraubenventil *P* lässt genau den Moment erkennen, in welchem nach Hebung der mit Quecksilber gefüllten Glaskugel *C* die Luft aus dem Gefäss *B* und der Manometerröhre *O* ausgeströmt ist. Dieser Moment tritt ein, sobald man nach Hochschrauben von *P*, Kügelchen von Quecksilber, welches der durch das Röhrchen *Y* entweichenden Luft folgt, in das Gefäss *T* ausfliessen sieht.

O. Braun in Berlin, Barometer (D. P. 20451). Das Instrument soll empfindlicher werden, ohne die Genauigkeit des einfachen Barometers zu verlieren. Die wünschenswerte Empfindlichkeit ist zwar

Fig. 325.



schon von Huyghens erreicht, aber es eignet sich bekanntlich sein Barometer nur zur Beobachtung der Schwankungen des Luftdruckes, aber nicht zum genauen Messen derselben, weil seine Angaben nicht nur von dem Durchmesser der Röhren und dem darum schwierig in Rechnung zu stellenden Einfluss der Temperatur sondern auch von der Menge des gerade vorhandenen Wassers abhängen Bei den unbequem langen und kostspieligen Glycerinbarometern ist der Einfluss der Temperatur uncontrolirbar. Die Verbesserung besteht nun darin, mittelst einer mit dem offenen Schenkel des Quecksilberbarometers *B* verbundenen Flüssigkeitssäule *c* zu messen, wieviel der jeweilige Luftdruck geringer ist als ein gewisser, z. B. 794 mm Quecksilbersäule. Sind z. B. 462·4 mm Wassersäule nötig, um die Quecksilbersäule auf 794 mm zu bringen, so ist der Luftdruck $794 - \frac{462{\cdot}4}{13{\cdot}6} = 760$ mm Quecksilbersäule. Die Scala *S* ist so geteilt, dass man daran direct die Grösse des Luftdruckes in Millimetern Quecksilber ablesen kann. Da Wasser angewendet wird, erhält das Millimeter eine Länge von 13·6 mm. Das nötige Wasser befindet sich in dem mit *C* durch Stutzen *g* und Rohr *h* verbundenen Gummiball *i*, welchen man mittelst Schraube *k* zusammendrückt, bis die den Fusspunkt der Flüssigkeitssäule *c* markirende Glasspitze *e* die Oberfläche des Quecksilbers berührt. Die zweite in dem luftleeren Raume eingeschmolzene Glasspitze *f* dient nur dazu, um bei Aufstellung des Instrumentes sich überzeugen zu können, dass die richtige Quecksilbermenge darin ist, die bei einer bestimmten Temperatur den Raum zwischen *e* und *f* genau ausfüllen muss.

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10. Galvanische Batterien und Elemente.

A. Michaud in Paris giebt den Elementengefässen von prismatischer Gestalt zwei gegenüberliegende Wandungen aus porösen Thonplatten, während die beiden anderen Wandungen aus Guttapercha oder gefirnisstem Holz bestehen. Soll das Elementengefäss zwei Erregungsflüssigkeiten enthalten, so wird es in der in Figur 326 gezeigten Form hergestellt. *cc* sind zwei an den Wänden *A* und *B* befestigte Kautschukbehälter mit durchlöchertem Boden, welche die Krystalle für die Kupferlösung aufnehmen. Eine Hebevorrichtung zur Abführung überschüssig eingeführter Lösung besteht aus der äusseren Glasröhre *t* (Fig. 327), dem inneren Kautschukröhrchen *ab* nebst daran sitzendem Glasröhrchen *bc*. Diese Anordnung soll das Eindringen von Luftblasen in das Capillarröhrchen *bc* verhindern, wodurch ein regelmässiges Fortschaffen der Flüssigkeit bewirkt wird. (D. P. 19512.)

Fig. 326.

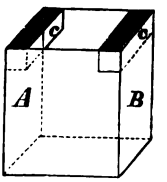

Fig. 327.

Theoph. Coad in London will einen stärkeren und gleichmässigeren Strom erzeugen, indem die Oberfläche der Kohlenplatte bei einem Zink-Kohlen-Element dadurch vergrössert wird, dass dieselbe durch Zusammenschrauben einzelner Platten mit Zwischenplatten durch Bolzen und Mutter, ebenfalls aus Kohle, hergestellt wird. (D. P. 19187.)

Bei dem Element von J. F. Aymonnet in Grignon dient als negativer Pol ein Metall aus der Eisenfamilie oder eine Verbindung dieser Metalle, als positiver Pol Retortenkohle oder Platin. Die Flüssigkeit, in welcher die Polplatten liegen, ist ein Gemisch aus zwei wässerigen Lösungen. Die eine enthält Salzsäure oder ein Chlorür. Die andere enthält entweder Salpetersäure oder ein Nitrat oder Chromsäure oder ein Chromat oder Bichromat oder ein Sesquichlorür oder Bichlorür. Die Zusammensetzung der Flüssigkeitsmischungen ist so gewählt, dass sich durch die chemische Reaction stets Chlor bildet, das auf das Eisen wirkt und es in ein Chlorür umwandelt, ohne dass Wasserstoff ausgeschieden wird. (D. P. 20495.)

Die von Higgin in Manchester angegebenen Elemente bestehen aus einem Gefäss von Glas oder Steingut, in welchem ein hohler Cylinder aus Zinn steht. In diesem Cylinder steht eine poröse Zelle, wie sie bei Bunsen-Elementen gebraucht werden. Im äusseren Gefäss wird verdünnte Schwefelsäure angewendet, und ebensolche enthält auch das poröse Gefäss, in welchem als depolarisirender Körper eine Kohleplatte steht, die von kleinen Stücken Mangansuperoxyd umgeben ist. Während der Tätigkeit des Elementes bilden sich schwefelsaures Zinnoxydul und schwefelsaures Manganoxydul. Die Lösung dieser Salze wird bei Erneuerung des Elementes gesammelt und auf zinnsaures Natrium oder Kalium verarbeitet. (D. P. 19856.)

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Die Batterie von Stebbins in New-York soll mit grossem Rauminhalt und kräftiger Wirkung ein lange Dauerhaftigkeit verbinden, und die Stärke des erzeugten Stromes soll nach Belieben regulirt werden können. Die innere Zelle des Elementes ist an ihrem oberen Teile, da, wo sie von porösen Wänden *e* umgeben ist, enger als der untere Teil *c'*, der als Flüssigkeitsbehälter dient und aus nicht porösen Wänden *C* gebildet ist. Aus diesem Behälter erhalten die positiven und negativen Polplatten *c* und *z* stets Zufluss von frischer Flüssigkeit. Die Wirkung kann vermindert oder ganz aufgehoben werden durch nicht poröse Schirme *f*, welche dicht vor den porösen Wänden *e* der inneren Zelle verstellbar angebracht sind. (D. P. 19924.)

Fig. 328.

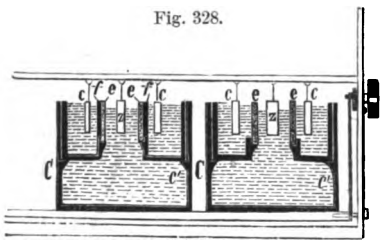
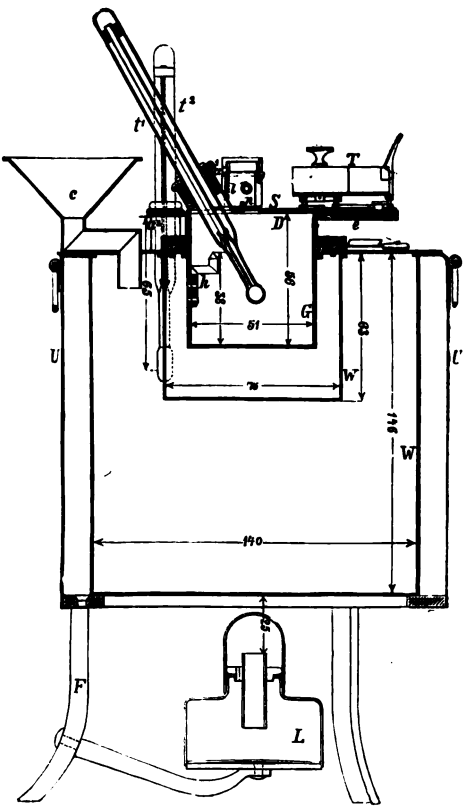


Fig. 329.



11. Petroleumprüfer.

Der durch Kaiserliche Verordnung vom 24. Februar 1882 zur Untersuchung des Petroleums auf seine Entflammbarkeit eingeführte Abel'sche Petroleumprober ist folgendermaassen eingerichtet. Das cylindrische Petroleumgefäss *G* (Durchmesser 51 mm, Höhe 58 mm) besitzt den in eine 38 mm vom Boden entfernte Spitze endigenden Haken *h* von ⌐- förmiger Gestalt, welcher als Füllmarke dient. Auf dem oberen Rand von *G* ist der messingene Deckel *D* dicht aufgepasst. Er hat einen cylindrischen Ansatz von 10 mm Höhe, innerhalb dessen die Deckplatte auf eine Stärke von 0·75 mm angedreht ist. An eine kreisförmige Scheibe schliesst sich ein Fortsatz, der den Dreh-

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zapfen für die Scheibe *S* und das Triebwerk *t* trägt und unten mit der Ebonitplatte *e* bekleidet ist. Dem Fortsatz gegenüber trägt der Deckel das unter 60° geneigte Ansatzrohr für das Thermometer t^1. Endlich befindet sich auf dem Deckel noch die Lampe *l* und ein Metallstift mit einer weissen Perle, die zum Anhalt bei Regulirung des Zündflämmchens dient. Im Deckel *D* sind drei viereckige Oeffnungen eingeschnitten, deren Mittellinien in einem um den Drehungsmittelpunkt des Schiebers *S* gezogenen Kreise liegen. Der Schieber *S* hat zwei diesen entsprechende Oeffnungen. Bei der Bewegung dieses Schiebers wird zugleich die Lampe *l* durch eine auf *S* sitzende Nase *n* gefasst und so geneigt, dass nach vollständiger Aufdeckung der Löcher das Zündungsflämmchen unter die Oberfläche des Deckels *D* gesenkt wird. Die Bewegung des Drehschiebers wird durch das Triebwerk *t* so bewirkt, dass die Aufdeckung der drei Löcher in zwei Secunden beendet ist. Der Wasserbehälter *W* besteht aus zwei Metallcylindern. Zwischen der inneren Wand derselben und der Wandung des Petroleumbehälters bleibt ein Raum 11 mm. Ein Ebonitring verhindert die metallische Berührung des Petroleum- und des Wasserbehälters. Die Deckplatte von *W* trägt ferner noch ein Ansatzrohr für das Thermometer t^2, sowie den Trichter *c*. Auf dem Tragring des Dreifusses *F* steht zunächst der kupferne Umhüllungsmantel *U*. *F* trägt auch die Spirituslampe *L*.

Bei Beginn einer Untersuchung wird zunächst der Barometerstand abgelesen und danach mit Hilfe einer Tabelle ermittelt, bei welchem Wärmegrad des Petroleums die Probe zu beginnen hat. Man füllt den Wasserbehälter mit Wasser von 50 bis 52° C., sättigt den Docht der Zündlampe *l* mit Petroleum und erwärmt das Wasserbad auf 54 bis 55° Das Petroleumgefäss ist unterdessen mittelst Pipette sorgfältig bis zur Marke gefüllt und wird dann eingesetzt. Nähert sich die Temperatur des Petroleums der aus der Tabelle ermittelten, so brennt man das Zündflämmchen an und regulirt dies so, dass es seiner Grösse nach der oben erwähnten Perle gleichkommt. Dann löst man das Triebwerk aus, worauf der Drehschieber seine Bewegung beginnt. Sobald das Zündflämmchen zunächst durch eine Art von Lichtschleier vergrössert wird und sodann eine blaue Flamme sich blitzartig über die ganze Fläche des Petroleums ausdehnt, liest man den Entflammungspunkt am Thermometer ab.

Wir bemerken hierzu, dass ausführliche Vorschriften über den Abel'schen Prober und seine Anwendung, sowie seine Prüfung und Beglaubigung, mit eingehenden Erläuterungen versehen, von der Kaiserlichen Normal-Aichungs-Commission zusammengestellt und in C. Heymann's Verlag in Berlin erschienen sind.

O. Braun in Berlin hat folgende Neuerung am Abel'schen Petroleumprober angebracht. (D. P. 19757.) Das Pendel *P* mit der daran befestigten Zündlampe Z dient dazu, die Bewegung der Zündflamme in dem über dem Petroleum *a* befindlichen Luftraum von der Geschicklichkeit des Beobach-

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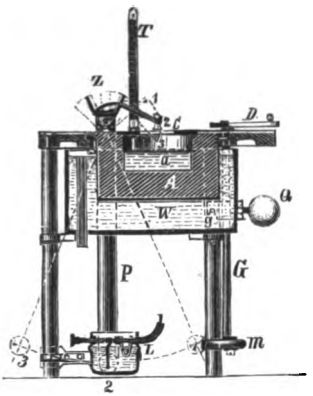
unabhängig zu machen. *P* wird zuerst angehalten durch den Magnet *m*, welcher an der um Stift *g* drehbaren und durch Gewicht *Q* in die gezeichnete Stellung zurückgebrachten Stange *G* befestigt ist. Die Auslösung von *P* geschieht durch Hebel *D*, welcher einen Schieber von der Oeffnung des Deckels *C* entfernt und zugleich durch Anschlag an *G* den Magnet *m* von *P* abreisst, so dass die Zündflamme mit *P* in die Stellung 3 gelangt, bei der sie in die über dem Petroleum befindlichen Dämpfe eintaucht. Ob diese sich hierbei entzünden, sieht man an dem Steigen des Thermometers *T*. Ein anderes Thermometer reicht bis auf den Grund des Gefässes *A* und misst die Temperatur des Petroleums, welches durch das Wasserbad *W* zuerst auf eine bestimmte Anfangstemperatur gebracht und durch das verschiebbare Petroleumlämpchen *L* nach Entfernung von *W* auf die Entflammungstemperatur erwärmt wird.

Fig. 330.



12. Verschiedene Apparate.

A. G. Vernon Harcourt in Oxford hat einen Apparat zur Bestimmung des Volumens eines Gases, welches unter gewöhnlichen Verhältnissen gemessen wird, bei den normalen Bedingungen angegeben. (Engl. P. 842 vom 21. Februar 1882.) Auf einem Kasten stehen zwei verticale Glasröhren von demselben Kaliber neben einander. Die eine ist oben offen, die andere endigt oben in eine Kugel von der $4^1/_2$fachen Capacität der Röhren (etwa 3·1 cbcm). Unten sind beide Röhren durch biegsame Röhren mit einem Quecksilberbehälter verbunden. Dieser hat eine Lederkappe, auf welche durch eine Schraube Druck ausgeübt werden kann. Die Röhre mit der Kugel ist graduirt. Sie enthält ein Volumen feuchter Luft, welches unter normalen Bedingungen 3·3 cbcm einnimmt. Der Rest der Röhre enthält Quecksilber. Dieses Volumen ist als 1000 bezeichnet; die Volumeneinheit ist zu $^1/_{300}$ cbcm angenommen. 930 wird dann etwa das kleinste Volumen bezeichnen, zu welchem die Luft durch niedrige Temperatur und hohen Luftdruck gebracht werden kann, während die entgegengesetzte Grenze wol nicht über 1140 liegen wird. Beim Gebrauch des Instruments bringt man nun durch geeigneten Druck auf das Quecksilber das Niveau desselben in beiden Röhren auf die gleiche Linie. Die Zahl giebt das unter den augenblicklichen Druck- und Temperaturverhältnissen gemessene Volumen einer Menge Luft an, die unter normalen Bedingungen 1000 cbcm einnimmt. Man hat also, wenn 980 die abgelesene Zahl ist, das Volumen des in irgend

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einem Behälter gewesenen Gases mit $\frac{1000}{980}$ zu multipliciren, um das Gasvolumen unter normalen Bedingungen zu erhalten.

Ein Apparat zum Messen der Geschwindigkeit von Flüssigkeiten und Gasen in Röhren und Ausflussmündungen von J. H. Zimmermann ist so construirt, dass der von der bewegten Flüssigkeit auf die Platte *g* geäusserte Druck sich mittelst Hebel *h* und Gelenkstück *l* auf den Zeiger überträgt. die Kraft der Feder *s* hält hierbei dem Druck das Gleichgewicht. Für die Messung der Geschwindigkeit und Menge der strömenden Flüssigkeit mittels communicirender Röhren ist die Anordnung getroffen worden, dass die letzteren mit Hähnen versehen sind, welche so weit zugedreht werden können, dass nur noch eine äusserst kleine Communication mit der Flüssigkeit bestehen bleibt, ein Umstand, welcher die Einwirkung von Stössen auf das U-Rohr abschwächt. Dadurch, dass das U-Rohr in einem Schiebestück gefasst ist, kann durch entsprechende Stellung des letzteren die Geschwindigkeit an verschiedenen Stellen des Canalquerschnittes ermittelt werden. (D. P. 21122.)

Fig. 331.

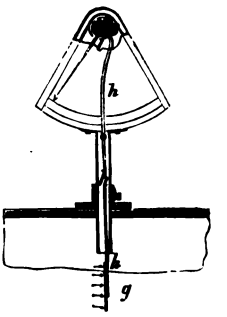
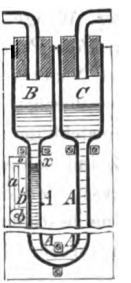
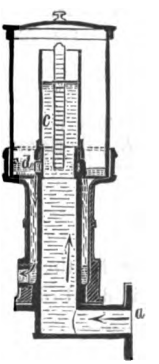


Fig. 332.



Bei dem von Seger und Aron in Berlin angegebenen Zugmesser wird die in dem einen Schenkel einer mit Flüssigkeit gefüllten communicirenden Röhre *AA* durch Luftüberdruck hervorgebrachte geringe Niveaudifferenz dadurch in vergrössertem Maassstabe messbar gemacht, dass man die Röhre *AA* an ihren oberen Enden mit Erweiterungsstücken *BC* versieht, sie mit zwei sich nicht mischenden Flüssigkeiten von gleichem spec. Gewicht derart füllt, dass die Berührungsstelle der Flüssigkeiten in das engere Rohr fällt (in der Fig. nach *x*) und dass man die Bewegung dieser Berührungsstelle in dem engeren Rohrteile *A* mittelst einer durch Schlitze *aa* und Stellschrauben *bb* verstellbaren Scala *D* misst, deren Nullpunkt bei *x* liegt. Ist z. B. das Querschnittsverhältnis von *A* zu *B* und *C* wie 1 : 20, so führt eine Senkung des Flüssigkeitsspiegels von *B* um 1 mm eine Verschiebung des Berührungspunktes *x* um 20 mm herbei, so dass sehr geringe Druckdifferenzen deutlich sichtbar gemacht werden können. (D. P. 19426.)

Fig. 333.



C. Heckmann in Berlin. Anzeiger für abfliessende Flüssigkeitsmengen (D. P. 19405). Der Ausfluss der bei *a* zuströmenden Flüssigkeit findet durch die Oeffnung *d* statt, deren Grösse abhängig ist von dem Durchschnittsquantum, welches pro Stunde abfliessen soll. Letzteres wird an

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einer Scala der aufgesetzten Glasröhre *c* beobachtet, da ein bestimmtes Quantum der durchfliessenden Flüssigkeit von der Druckhöhe im Rohre *c* abhängig ist.

Eugen Langen in Köln a. Rh. hat einen Apparat zur continuirlichen Registrirung der in einer Lösung enthaltenen Mengen einer bestimmten Substanz (Densograph) construirt. Derselbe besteht aus der Combination einer Waage *W* zur Bestimmung des absoluten und einer Waage *A* zur Ermittelung des specifischen Gewichts der den Apparat durchströmenden Lösung. Jeder Hub von *W* wird durch den Hebel *Q* und die Stange *R* dem Sperrrad *S* mitgeteilt. Sowie dieses eine Umdrehung gemacht hat, schnellt es den Hebedaumen *T* gegen den Hebel *U* und dadurch den mit *U* auf der selben Achse sitzenden Bügel *J* gegen die Nadel *N*, welche an der Zunge *Z* der Waage *A* angebracht ist. Infolgedessen wird *N* in einen Papierstreifen *P* gedrückt, welcher durch ein Uhrwerk in senkrechter Richtung vor der Nadel vorbeigeführt wird. Wenn auf diese Weise das absolute Gewicht der durchströmenden Lösung gemessen wird, so erhält man das specifische Gewicht derselben durch den grösseren oder geringeren Ausschlag der Zunge *Z*, indem die Lösung nach Passirung der Waage *W* bei *x* in das Gefäss *E* fliesst, den Senkkörper *C*, welcher an *B* hängt und durch Gewicht *A* für eine bestimmte Menge gelöster Substanz ausbalancirt ist, ihrer Dichtigkeit entsprechend hebt und dadurch den Waagebalken *A* nebt *Z* und *N* bewegt. Durch Versuche ist nun die Beziehung zwischen dem gesuchten specifischen Gewicht und der Abweichung der Nadel *N* nach rechts oder links ermittelt und danach auf dem Papierstreifen *P* eine Scala verzeichnet. (D. P. 20672.)

Fig. 334.

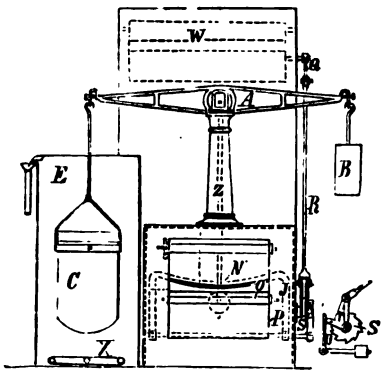
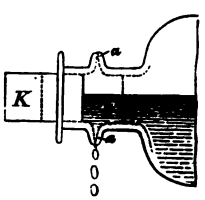


Fig. 335.



Lamprecht und Hirdes haben ihren Tropfenzähler*) jetzt so eingerichtet: Es sind zwei Zapfen *a a* mit genau gleichen Oeffnungen angebracht, so dass nach Zurückziehung des Stöpsels *k* bei waagerechter Lage des Glases aus dem einen Zapfen die Tropfen herausfallen, während durch den anderen Luft nachdringt (D. P. 20923).

Hugo Schickert in Dresden hat einen Apparat zur Bestimmung der Druckfestigkeit von Materialien construirt, der für die Prüfung von Baumaterialien wichtig ist. Die Uebertragung des durch

*) Techn.-chem. Jahrb. 1883, S. 416.

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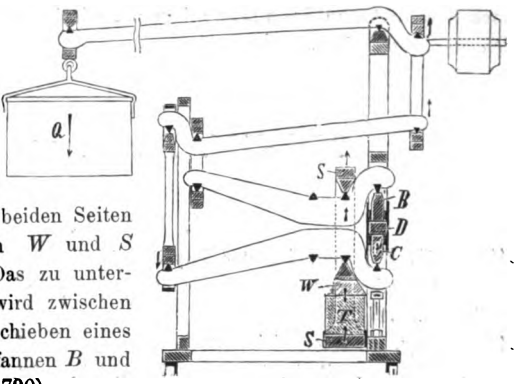
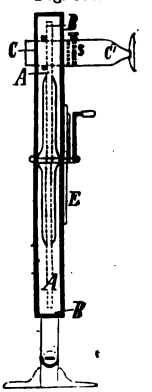
Gewicht Q hervorgebrachten Druckes auf das Probestück T geschieht mittelst Hebelübersetzung. Zur Einleitung der erforderlichen mechanischen Arbeit wird ein Gehänge S benutzt, so dass gleichzeitig von beiden Seiten auf die Anschlussbacken W und S Druck ausgeübt wird. Das zu untersuchende Materialstück wird zwischen diese Backen durch Einschieben eines Keiles D zwischen die Pfannen B und C eingespannt (D. P. 18790).

Fig. 336.



Das Photometer von Otto in Frankfurt a. M. besteht aus der das Durchfallen des Lichtes nach Sectoren stufenweise abschwächenden transparenten Scheibe A, welche vermittelst einer Kurbel innerhalb der Dunkelkammer B gedreht wird. Diese hat an zwei gegenüberliegenden Punkten der beiden Seitenflächen in der Nähe des Umfangs von A Ausschnitte, in welche lichtdicht schliessend die beiden Röhren C und C^1 eingefügt sind. Erstere ist der zu messenden Lichtquelle zugewendet und leitet das Licht nach A. Durch diese Scheibe abgeschwächt kommt das Licht nach C^1. Diese Röhre hat eine Scheidewand aus mattirtem, weissem Glase, hinter welcher sie sich allmälig zu einer der Augenpupille des Beobachters entsprechenden Oeffnung verengt. Als Controlvorrichtung dient ein verstellbares, aus zwei Eisenstäbchen gebildetes Kreuz s, welches eben verschwinden muss. Dann wird auf dem Zifferblatt E die mit A vorgenommene Drehung abgelesen. Auch darf eine Bewegung nicht wahrgenommen werden, wenn der eine Arm des Kreuzes s um die Achse gedreht wird. (D. P. 19300.)

Fig. 337.



Ein Apparat zur Prüfung alkoholischer Flüssigkeiten von J. A. Devèze in Bordeaux ist im Engl. P. 250 vom 18. Januar 1882 beschrieben. In einem mit Kühler versehenen Destillationsapparat wird eine gewisse Menge der Flüssigkeit der Destillation unterworfen. Das Destillat wird in einem Gefäss aufgefangen, bis ein markirtes Volumen erlangt ist. Dies Gefäss hängt an dem einen Arm einer empfindlichen Waage, auf deren anderem Arm ein Laufgewicht verschiebbar ist. Die Scala auf diesem Arm giebt den alkoholischen Procentgehalt der Flüssigkeit an.

W. Osten in Hamburg. Apparat zum Butterprüfen. (D. P. 19078.) Ein graduirter Glascylinder ist so eingerichtet, dass 100 Teile den Raum angeben, den 50 g Butter einnehmen. Nach der Füllung wird die Butter

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durch Eintauchen des Gefässes in warmes Wasser zum Schmelzen gebracht. Nach dem Erstarren kann man erkennen, wieviel mechanische Beimengungen sich abgesetzt haben.

XXXIX. Bücherschau.*)

I. Physik.

Abendroth, W., Leitfaden der Physik mit Einschluss der einfachsten Lehren der Chemie und mathematischen Geographie. 1. Cursus 8°. Leipzig, Hirzel. ℳ 2.

Albert-Levy, Premiers éléments des sciences expérimentales. 2 édit. 290 p. avec 190 fig. Paris, Hachette & Co. fr. 2,50.

Baille, J., L'Electricité. 5. édit. 18°. 319 S. Paris, Hachette & Co. fr. 2,25.

Beetz, W. v., Leitfaden der Physik. 7. Aufl. 8°. Leipzig, Grieben's Verlag. ℳ 4.

Behrend, G., Das elektrische Licht. Kurze Darstellung für Jedermann. 8°. Halle, Knapp. ℳ 1,20.

Bowman, F. H., The Intermediate Text Book of Physical Science. Illustrated. 12°. 338 p. London, Cassel. sh. 3,6.

Box, T., A Practical Treatise on Heat. 4 edit. Post-8°. 300 p. London, Spons. sh. 12,6.

Chevreul, E., The Law of Contrast of Colour. Translated from the French by *John Spanton*. Post-8°. 241 p. London, Rontledge. sh. 3,6.

Courtin, A. J., Théorie mécanique de la chaleur. 3 édit. In-8°. Paris, Gauthier-Villars. fr. 6.

Crüger, J., Lehrbuch der Physik. 5. Aufl. 8°. Leipzig, G. W. Körner. ℳ 4,50.

Devillez, A., Traité élémentaire de la chaleur au point de vue de son emploi comme force motrice. 2 vols. in-8° avec planches. fr. 25

Dewar, D., A new Theory of Nature; containing observations on weather, tides, capillary attraction, and sunspots. With illustrative experiments. Post-8°. 94 p. London, Reeves. sh. 5.

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*) Dies ist eine Zusammenstellung der Titel von den grösseren Publicationen, die im Laufe des Berichtjahres erschienen sind, insofern dieselben vornehmlich das Gebiet der Chemie, sodann auch der Physik, Mineralogie, Geologie, Botanik betreffen, welchem Verzeichnis noch die Titel solcher Bücher hinzugefügt sind, die für den Chemiker von allgemeinerem Interesse sein mögen. Bücher, die uns von den Herren Verfassern oder Verlegern zugesendet werden, erfahren von den Autoren des Techn.-chem. Jahrbuchs eine sachliche Besprechung.

Ein Teil der folgenden Referate ist, dem wesentlichen Inhalt nach, bereits in der von M. Roediger herausgegebenen Deutschen Litteratur-Zeitung erschienen.

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Dippel, L., Das Mikroskop und seine Anwendung. 2. Aufl. 1. Th. Handbuch der allgemeinen Mikroskopie. 8°. 1030 S. Braunschweig, Vieweg & Sohn. *M* 34.

Dies schöne Werk giebt eine umfassende Anleitung zur theoretischen Kenntnis des Mikroskops und der mikroskopischen Hilfsapparate, sowie eine nie im Stich lassende Anweisung zur Handhabung desselben. Das Buch ist auf zwei Teile berechnet: 1. Handbuch der allgemeinen Mikroskopie; 2. Untersuchungsmethoden der vegetabilischen Gewebslehre. Der erste Teil liegt vollständig vor. Derselbe umfasst den ganzen Inhalt der mikroskopischen Wissenschaft, welcher folgendermaassen eingeteilt ist: Erstes Buch, Theorie der Bilderzeugung und Beleuchtung; Zweites Buch, Das Mikroskop, Theorie, Einrichtung, optisches Vermögen und Prüfung; Drittes Buch, Hilfsmittel der mikroskopischen Technik; Viertes Buch, Gebrauch des Mikroskops und Untersuchungsmethoden. In dem ersten Buch sind die ausgezeichneten (zum Teil bisher noch nicht veröffentlichten) Untersuchungen und theoretischen Entwickelungen *Abbe*'s dem allgemeinen Verständnis zugänglich gemacht — die geometrischen Gesetze der Abbildung für Linsen und Linsensystem, des Stralenganges und der Beleuchtung, die physikalischen Bedingungen der Bilderzeugung nicht leuchtender Körper — und auf dieser Grundlage sind die ferneren Abschnitte aufgebaut. Der Herr Verf. hat von mathematischen Entwickelungen nur sparsamen Gebrauch gemacht. Dies sowol, wie vor allem die klare verständliche Darstellung macht das Buch zum Gebrauch weitester Kreise geeignet. Der Studirende, der naturwissenschaftliche Lehrer, der Pharmaceut, der Arzt, jeder Freund der Mikroskopie, Jeder, der auch ohne besondere Vorkenntnisse die Welt des Kleinen kennen zu lernen wünscht, sie Alle werden mit grosser Befriedigung dies vortreffliche Werk benutzen, das auf seinem Gebiete von keinem anderen übertroffen wird. Dass die reichlich angewendete Illustration immer mustergiltig ist, versteht sich beeinem Buche des Vieweg'schen Verlags von selbst.

Emsmann, H., Physikalische Aufgaben nebst ihrer Auflösung. 4. Aufl. 8°. Leipzig, O. Wiegand. *M* 4.

Everett, J. D., Unités et constantes physiques. Traduit de l'Anglais par *Jules Raynaud*. In-8°. XVI—200 p. Paris, Gauthier-Villars. fr. 4.

Favaro, A., Galileo Galilei e lo studio di Padova. 8°. Florenz, Le Monnier Succ. L. 15.

Faraday, M., Experimental Researches in Electricity. Facsimile reprint. 3 vols. 8°. London, Quaritch. sh. 48.

Fleury et *Duguet*, Traité de physique élémentaire, rédigé conformément aux programmes officiels. T. 1. In-12°. 280 p. avec fig. Bruxelles. fr. 2,50.

Fourier, M., Théorie analytique de la chaleur. Nouvelle édit. 2—5 Livr. (Fin). 4°. Breslau, Koebner. à *M* 8.

Gariel, C. M., Traité pratique d'électricité, comprenant les applications aux sciences et à l'industrie. 1 fasc. In-8°. VIII p. et p. 1 à 208, avec fig. Paris, Doni fr. 6.

Gerland, E., Beiträge zur Geschichte der Physik. 4°. Leipzig, Engelmann. *M* 1.

— Licht und Wärme. (Das Wissen der Gegenwart. 12. Bd.) 8°. 320 S. mit 4 Portraits und 128 Holzschnitten. Leipzig, Freitag. Geb. *M* 1.

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Getz, K., Lærebog i fysik for middelskolen. Andet oplag. 8°. 2 Bl. 110 s. med 78 fig. Kristiania, Aschehoug. kr. 1,20.

Gossin, H., Cours élementaire de physique. Nouv. édit. In-12°. Paris, Hachette & Co. fr. 3.

Greer, H., A Dictionary of Electricity. Illustrated. 12°. New-York. sh. 12.

Gripon, E., Cours élémentaire de physique. Electricité. In-12°. 239 p. avec fig. Paris, V. Bélin et fils.

Guillemin, A., Le monde physique. 3 vols. In-8°. Paris, Hachette & Co.

Helmholtz, H., Wissenschaftliche Abhandlungen. 2. Bd. 8°. Leipzig, Barth. *M* 20.

Hollefreund, K., Die Gesetze der Lichtbewegung in doppelt brechenden Medien nach der Lommel'schen „Reibungstheorie" und ihre Uebereinstimmung mit der Erfahrung. 4°. Leipzig, Engelmann. *M* 2.

Jacob, C., Die Kräfte in der Natur, insbesondere über einige Wirkungen der Kraft der Cohäsion und Adhäsion bei Stoffmischungen, sowie über das Wesen der Elektricität und des Magnetismus. 8°. Würzburg, Stahel. *M* 2,20.

Jouffret, E., Introduction à la théorie de l'énergie. In-8°. 200 p. Paris, Gauthier-Villars. fr. 3,50.

Kayser, H., Lehrbuch der Spectralanalyse. 8°. Berlin, Springer. *M* 10.

Larden, W., A School Course of Heat. With numerons illustr. 8°. London, Low & Co. sh. 5.

Latteux, P., Manuel de technique microscopique, ou guide pratique pour l'étude et le maniement du microscope. 2 édit. In-18° jésus. XI—477 p. avec 177 fig. Paris, Delahaye & Lecrosnier.

Lindner, M., Die Elektricität im Dienste von Gewerbe und Industrie. 4° Leipzig, Knapp. *M* 5.

Maxwell, J. C., Lehrbuch der Elektricität und des Magnetismus. Autorisirte deutsche Uebersetzung von *B. Weinstein*. 1. Bd. 8°. Berlin, Springer. *M* 12.

Mohn, H., Grundzüge der Meteorologie. Die Lehre vom Wind und Wetter. 3. Aufl. 8°. Berlin, D. Reimer. Geb. *M* 8.

Montigny, Ch., Les grandes découvertes faites en Physique depuis la fin du XVIII siècle. 8°. Bruxelles, Hayez.

Mousson, A., Die Physik auf Grundlage der Erfahrung. 3. Bd. 2. Lfg. (1. Hälfte). Die Lehre vom Galvanismus. 3. Aufl. 8°. Zürich, Schulthess. *M* 5,40.

Naville, Ernest, La Physique moderne. In-8°. Paris, Baillère & Co. fr. 5.

Olmsted, D., An Introduction to Natural Philosophy. 3 edit. Revised by *R. G. Kimball*. 8°. New-York. sh. 18.

Puluj, J., Stralende Elektroden-Materie und der sogenannte vierte Aggregat-Zustand. 8°. Wien, Gerold's Sohn. *M* 2,80.

Regodt, H., Notions de physique applicables aux usages de la vie. 29 édit. In-12°. VIII—380 p. avec 200 fig. Paris, Delalein frères.

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Reis, P., Elemente der Physik, Meteorologie und mathematischen Geographie. Hilfsbuch für den Unterricht an höheren Lehranstalten. 2. Aufl. Leipzig, Quandt & Händel. ℳ 4,50.

Saint-Edme, E., Premiers éléments de physique industrielle. 3 édit. In-8° jesus. 372 p. avec figures. Paris, Delagrave.

Sattler, A., Leitfaden der Physik und Chemie. Für die oberen Klassen von Bürgerschulen. 3. Aufl. 8°. Braunschweig, Vieweg & Sohn. ℳ —,80.

Schellen, H., Die magnet- und dynamo-elektrischen Maschinen, ihre Construction und praktische Anwendung zur elektrischen Beleuchtung und Kraftübertragung. 3. Aufl. 1. Hälfte. 8°. Cöln, DuMont-Schauberg. ℳ 8.

— Der elektro-magnetische Telegraph in den Hauptstadien seiner Entwickelung. 6. Aufl. Bearbeitet von *J. Kareis*. 1. u. 2. Liefg. 8°. Braunschweig, Vieweg & Sohn. ℳ 6.

Siemens, Sir W., Einige wissenschaftlich-technische Fragen der Gegenwart. 2. Folge. 8°. Berlin, Springer. ℳ 2,40.

— *C. W.*, Nouvelle théorie du soleil: Conservation de l'énergie solaire. Traduit par *Gustave Richard*. Suivi d'une note sur la reconcentration de l'énergie de l'univers par *W. J. M. Rankine*. In-18° jesus. 51 p. Paris, Gauthier-Villars.

Stallo, J. B., The Concepts and Theories of modern Physics. Cr.-8° 314 p. London, Paul. sh. 5.

Stewart, B., Physik. Deutsche Ausgabe von *E. Warburg*. 3. Aufl. 12°. Strassburg, Trübner. ℳ —,80.

Sumpf, K., Schulphysik. Methodisches Lehr- und Uebungsbuch für den Gebrauch beim Unterricht an höheren Schulen. 8°. Hildesheim, Lax. ℳ 4,50.

Thompson, J. P., Elementary Lessons in Electricity and Magnetism. New edit. 18°. 464 p. London, Macmillan. sh. 4,6.

— *Sylvanus, P.*, Philipp Reis, the inventor of the Telephone: a biographical sketch, with documentary testimony, translations of the original papers of the inventor, and contemporary publications. 8°. 195 p. London, Spon. sh. 7,6.

Thomson, Sir *W.*, and *P. G. Tait*, Treatise on Natural Philosophy. New edit. Vol. 1, Part. 2. 8°. 540 p. London, Cambridge, Warehouse. sh. 18.

Trutat, E., Traité élémentaire du microscope. 1. partie: Le microscope et son emploi. 8°. 322 p. Paris, Gauthier & Villars.

Tyndall, J., Six Lectures on Light, delivered in the United States in 1872—73. 3 édit. Post-8°. 272 p. London, Longmans. sh. 7,6.

Verdet, E., Vorlesungen über die Wellentheorie des Lichtes. Deutsche Bearbeitung von *K. Exner* 1. Bd. 2. Abth. 8°. Braunschweig, Vieweg & Sohn. ℳ 4.

Wassmuth, A., Lehrbuch der Physik für die unteren Klassen der Mittelschulen. 2. Aufl. 8°. Wien, Hölder. ℳ 2,40.

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Weber, *H.*, Der Rotationsinductor, seine Theorie und seine Anwendung zur Bestimmung des Ohm in absoluten Maassen. 8°. Leipzig, Teubner. ℳ 2,40.

Wiedemann, *G.*, Die Lehre von der Elektricität. 3. Aufl. 2. Bd. 8°. Braunschweig, Vieweg & Sohn. ℳ 25.

Wits, *A.*, L'Ecole pratique de physique, cours de manipulations de physique préparatoire à la science. In-8°. XIV—506 p. avec 160 fig. Paris, Gauthier-Villars. fr. 12.

Wright, *L.*, Light; a Course of Experimental Optics, chiefly with the Lantern. 8°. London, Macmillan. sh. 7,6.

II. Chemie.

Rud. Arendt, General-Register zum Chemischen Centralblatt. Jahrgang 1870 bis 1881. Hamburg und Leipzig, Leopold Voss. 1883. Lex. 8°. 30 ℳ.

Das Chemische Centralblatt unter der vortrefflichen Redaction des Herrn *R. Arendt* ist den Chemikern seit vielen Jahren ein guter Freund gewesen, weil in ihm alle chemischen Forschungen, wenn sie nicht gar zu unbedeutend sind, in ungewöhnlich klarer und dabei knapper Weise mitgeteilt werden. Der Referent hat aus dem Munde *Liebig*'s mehr als einmal gehört: „Ich schöpfe meine Weisheit aus dem Chemischen Centralblatt." Für die letzten 10 Jahrgänge dieser Zeitschrift ist jetzt ein Register erschienen, das in seiner Art den Gipfel der Vollkommenheit erreicht hat. Das Autorenregister enthält über 30 000, das Sachregister über 50 000 Artikel. In letzterem sind nicht nur die Ueberschriften der einzelnen Arbeiten gegeben, sondern der Inhalt einer jeden ist durchgearbeitet und jedem Artikel ist der Name des Autors hinzugefügt. Das Register ist nicht allein für die Besitzer des Chemischen Centralblattes von Wert, sondern für jeden Chemiker, da es ein ausführliches und vollständiges Nachschlagebuch über alle Publicationen auf dem Gebiete der reinen und angewandten Chemie ist, welche innerhalb des letzten Decenniums erschienen sind.

Arnold, *E.*, Kurze Anleitung zur qualitativen chemischen Analyse. 8°. Hannover. ℳ 2,40.

Barnes, *J.*, Tables for the Qualitative Analysis: or, „Simple Salts" and „Easy Mixtures". 12°. 48 p. Manchester. sh. 1.

Beilstein, *F.*, Anleitung zur qualitativen chemischen Analyse. 5. Aufl. 8°. Leipzig, Quandt & Händel. ℳ 1,20.

— Manuel d'analyse chimique qualitative; Traduction française par *A.* et *P. Buisine*. In-8°. 135 p. Paris, Masson.

Blas, *C.*, Méthode de l'analyse qualitative minérale par la voie humide, avec un appendice relatif à la recherche des acides organiques, ainsi que des alcaloïdes et des principes immediats les plus importants des plantes. 2 édit., augmentée d'un essai de méthode d'analyse électrolytique. In-12°. 227 p. Bruxelles. fr. 5.

Bloxam, *C. L.*, Chemistry, Inorganic and Organic. With Experiments. 5 edit. 8°. 694 p. London, Churchill. sh. 16.

Brown, *J. C.*, Practical Chemistry. Analytical Tables and Exercises for Students. 2 edit. 8°. 52 p. London, Churchill. sh. 2,6.

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Cornwall, H. B., Manual of Blowpipe Analysis, qualitative and quantitative: with a complete system of determinative Mineralogy. 8°. New-York. sh. 12,6.

Debray, H., et *A. Joly*, Cours de chimie 4 édit. T. 1. Métalloïdes. 8°. Paris, Dunod.

Delaurier, E., Essai d'une théorie générale supérieure de philosophie naturelle et de thermochimie, avec une nouvelle nomenclature binaire notative pour la chimie minérale et organique. Paris, impr. Lahure.

Draper, J. C., Practical Laboratory Course in Medical Chemistry. New-York. sh. 5.

Encyklopädie der Naturwissenschaften. Breslau, Ed. Trewendt; à Lieferung 3 *M.*

Dieses monumentale Werk ist während des Berichtsjahres um ein gutes Stück der Vollendung entgegengeführt worden. Wir erwähnen von den neu erschienenen Lieferungen Folgendes.

Handwörterbuch der Mineralogie, Geologie und Paläontologie. 2. bis 5. Lieferung.

Die Herren *Kenngott*, *von Lasaulx*, *Rolle* haben wiederum eine Reihe höchst wertvoller Monographien geliefert, die in anerkennenswerter Weise gemeinfassliche Darstellung mit strenger Wissenschaftlichkeit verbinden. Von grösseren Abhandlungen, die namentlich auch für den gebildeten Nichtfachmann von grossem Wert sein werden, seien hervorgehoben: Edelsteine, Erze, Harze von Herrn *Kenngott*; der Erdball als Ganzes und seine Beschaffenheit, die Erdbeben, die Gebirge, die Aufgabe der Geologie von Herrn *von Lasaulx*, sowie einige paläontologische Aufsätze von Herrn *Rolle*.

Handbuch der Botanik. 12., 13. und 14. Lieferung.

Das in neuerer Zeit so eminent wichtig gewordene Gebiet der Spaltpilze ist von Herrn *Zopf* ausführlich bearbeitet worden. Der übrige Teil wird von einer hervorragenden Arbeit des Herrn *Göbel* über Vergleichende Entwickelungsgeschichte der Pflanzenorgane in Anspruch genommen. In die Fülle der Formen, welche die Pflanzenwelt uns darbietet, wird eine Gesetzmässigkeit gebracht, die den Leser um so mehr erfreut, je weiter er in das Studium des immer interessant beschriebenen und durch viele und schöne Illustrationen erläuterten Gegenstandes eindringt.

Handwörterbuch der Pharmakognosie des Pflanzenreichs. Von *G. C. Wittstein.*

Dieses Werk ist von dem Herrn Verfasser zu Ende geführt. Die Eigentümlichkeiten und Vorzüge des Buches sind schon früher hervorgehoben worden. Dafür, dass der Herr Verfasser, aus dem reichen Schatze seiner philologischen Gelehrsamkeit schöpfend, der Beschreibung der pharmaceutischen Pflanzen und Drogen die meistens höchst interessanten, etymologischen Angaben zugefügt hat, muss man ihm besonderen Dank aussprechen. Dem Buche sind noch zwei Anhänge und drei Register beigegeben. Der erste Anhang enthält die systematische Aufzählung von Mutterpflanzen sämmtlicher Drogen nach dem natürlichen Systeme geordnet, und der zweite die nach den betreffenden Pflanzenteilen gruppirte Zusammenstellung derselben. Von den drei Registern enthält das erste die deutschen Drogennamen, das zweite die officinellen lateinischen Drogennamen, und das dritte die systematischen lateinischen Namen der Mutterpflanzen, alle drei in alphabetischer Reihenfolge.

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Handwörterbuch der Chemie. Herausgegeben von *A. Ladenburg*. 2. bis 6. Lief.

Von grosser Bedeutung für den Wert dieses Buches ist es, dass die physikalisch-chemischen Artikel von einem so ausgezeichneten Gelehrten wie Herrn *E. Wiedemann* baarbeitet werden. Wir machen besonders auf die Artikel „Aggregatzustände" und „Atomtheorie" aufmerksam. Die Arbeit über Alkaloide von Herrn *O. Jacobsen* ist wol die vollständigste Monographie über diese Körpergruppe. Derselbe Verf. hat noch einen Artikel über aromatische Säuren geschrieben. Erwähnt seien noch von grösseren Aufsätzen der über Aluminium von Herrn *Weddige*, Anilin von demselben, Analyse von Herrn *Tollens*, Aromatische Verbindungen von Herrn *Ladenburg*, Antimon und Arsen von Herrn *Heumann*, Alkoholfabrikation von Herrn *Engler*. Die Zusammenfassung vieler Thatsachen und deren Vergleichung von einheitlichen Gesichtspunkten aus in Artikeln wie „Aromatische Verbindungen", „Alkohole" (von Herrn *Rüdheimer*), „Aldehyde" (von Herrn *v. Richter*) ist sehr lehrreich. Dies, sowie die Fülle des thatsächlichen Materials wird das *Ladenburg*'sche Handwörterbuch zu einem der besten chemischen Handbücher machen.

Encyclopédie chimique, publiée sous la direction de *M. Fremy*. Paris, Dunod, 1882—83.

Dies grosse Werk wächst rasch seiner Vollendung zu. Wir wollen die im Berichtjahre erschienenen Lieferungen kurz aufzählen.

Tome V. Metallurgie: Principes généraux, par *M. Gruner*. 8°. 94 S. fr. 5.

Es ist sehr interessant und lehrreich, diese Aufsätze des berümten Metallurgen zu studiren, der mit Männern, wie *C. W. Siemens*, *Lowthian Bell*, *Wedding*, *Kerl*, *Kerpely* an der Spitze seines Faches steht. In dieser nach vielen Richtungen hin bedeutenden Publication werden abgehandelt: die Erze, Flussmittel, Oxydations- und Reductionsmittel, feuerfesten Materialien, Brennstoffe, natürliche, vercokte, agglomerirte, gasförmige, die Oefen und Gebläse, die Verbrennung, Calcination und Schmelzung, die Reductions- und Oxydationsprocesse, die Röstung, Affinage, die Verfahren auf nassem Wege, die elektrochemischen und mechanischen Verfahren und endlich die allgemeinen Eigenschaften der Metalle.

Tome V. Applications de la Chimie inorganique, par *M. Sorel*. 1er fascicule: Soufre, Acide sulfurique, Sulfure de carbone, Salpètre, Acide nitrique. 8°. 351 S. Fr. 20. 2e fascicule: Sel marin, Sulfate de soude, Acide chlorhydrique, Potasse, Soude procédé Leblanc, Carbonate de soude par l'ammoniaque, Soude par le cryolithe. 8°. 742 S. Fr. 20.

Diese Monographie ist begreiflicherweise nicht so detaillirt wie die grösseren Specialwerke über die chemische Grossindustrie, zumal die rein wissenschaftlichen Erörterungen und die analytischen Verfahren sind nur gestreift, da beides ja den Gegenstand besonderer Teile der Encyclopädie ausmachen wird. Indessen finden wir alle notwendigen Angaben über den Gang der Operationen und die angewendeten Apparate. Im allgemeinen sind die wichtigeren neuen Fortschritte und Erfindungen auf dem Gebiete der chemischen Industrie gebührend berücksichtigt worden. Wie es nicht anders sein kann, ist das ausführlichste Werk über Sodafabrikation, *Lunge*'s ausgezeichnetes Handbuch, vielfach benutzt worden, auch Illustrationen sind demselben entlehnt. Die Original-Illustrationen (wol meistens chemigraphischer Zinkdruck) stechen in der Art der Ausführung nicht zu ihrem Vorteil von diesen ab, zeigen aber manches Neue. Viele neue Angaben findet der Leser über die Gewinnung des natürlichen Schwefels in verschiedenen Ländern, sowie

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des Chilesalpeters. Für andere Capitel, namentlich die Industrie der Stassfurter Salze, hätte der Herr Verf. die Patentlitteratur mehr benutzen müssen. Wir können aber im allgemeinen wegen der vielen Neuheiten und des gesunden Urteils auch dem deutschen technischen Chemiker das Studium des Werkes sehr empfehlen.

Tome V. Applications de Chimie inorganique 5e fascicule: Le verre et le cristal, avec atlas, par *M. J. Henrivaux.* 1883. 8°. 530 S. 30 Fr.

Der Herr Verfasser ist einer der Directoren der weltberümten Spiegelglas-Manufactur zu St. Gobain und war als solcher wol in der Lage, ein Werk über Glasindustrie zu liefern, welches auf der Höhe der Zeit steht. Wir müssen sagen, er hat seine Aufgabe glänzend gelöst. Dieses Buch nimmt neben den bekannten Werken von *Peligot* und von *Benrath* einen ehrenvollen Platz ein; keine unter den wichtigen Neuerungen, die seit dem Erscheinen der genannten Bücher hervorgetreten sind, ist dem Herrn Verfasser entgangen. Auch hat er sich bei Abfassung seines Buches des Beistandes von Autoritäten wie *Bontemps, Peligot, C. W.* und *Friedr. Siemens, Steinmann, Fahdt, Benrath,* zu erfreuen gehabt. Auch dies ist ein Beweis für die grosse Sorgfalt, mit der dies Buch verfasst ist, sowie für die Zuverlässigkeit und Vollständigkeit desselben. In letzterer Eigenschaft steht das Buch unerreicht da. Es ist nicht nur die Geschichte, Fabrikation, Verarbeitung, Verzierung aller Glasgegenstände geschildert, sondern auch das kunstgewerbliche Element und die Statistik der Glaswaaren der meisten Länder ist berücksichtigt worden. Ausser den zahlreichen Illustrationen im Text ist noch ein Atlas mit 26 schönen Tafeln beigegeben. Dies Werk wird ohne Zweifel sich sehr viele Freunde erwerben.

Tome VI. Chimie organique. 1. Généralités par *M. Villiers*; 2. Carbures d'Hydrogène par *M Bourgoin.* 8°. 120 und 762 S.

Der erste Teil enthält zunächst einige allgemeine Bemerkungen über die organischen Verbindungen (Isomerie, Homologie etc.), sodann einen Abriss der organischen Analyse und Dampfdichtebestimmung, weiter ein Capitel über orgnnische Synthese, über die Gruppen der organischen Körper, über die typische und atomistische Bezeichnungsweise. Der längst beseitigten Typentheorie ist unseres Erachtens ein zu grosser, der heutigen Molecular-Constitution ein zu geringer Raum gewidmet. In der Encyclopédie herrscht, wie wir früher schon bemerkt haben, die Schreibung nach Aequivalentformeln, und in diesem Teile des Werkes sind alle von *Berthelot* angegebenen Gründe gegen die Wertigkeits- und Structurtheorie in's Feld geführt.

Der zweite Teil behandelt in sehr vollständiger Weise die Kohlenwasserstoffe. Die Anordnung ist eine vortreffliche und an der Darstellung ist nichts auszusetzen. Das Werk enthält eine lange bibliographische Liste, aber ein Sachregister fehlt, wie in der Regel in französischen wissenschaftlichen Werken. Wenn die übrigen Teile der organischen Chemie in gleicher Vollkommenheit ausgearbeitet werden, so wird die chemische Litteratur um ein Normalwerk reicher sein.

Tome IX. Chimie biologique et physiologique. 1e section: Microbiologie par *M. Duclaux.* 1883. 8°. 896 S.

Dass die Lehre der Fermente und der Gährungserscheinungen in die Encyclopädie aufgenommen worden ist, kann man nur billigen, um so mehr, wenn dabei ein Werk wie das vorliegende resultirt, welches zum ersten Male alle die hunderte von auf diesen so interessanten wie verwickelten Gegenstand bezüglichen Arbeiten sammelt, kritisch sichtet und unter einheitlichen Gesichtspunkten zusammenfasst. Die Ansichten *Pasteur*'s beherrschen diese

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Arbeit. Es verdient bemerkt zu werden, dass, obgleich bekanntermaassen die Ansichten *Fremy*'s über die Gährungsprocesse denen *Pasteur*'s vielfach entgegengesetzt sind, dennoch einem Schüler des letzteren die Abfassung dieses Buches übertragen worden ist. Die so wichtigen und häufig noch so geheimnisvollen Erscheinungen der „Mikrobiologie", der Physiologie der kleinen und doch so Grosses, Nützliches und Unheilvolles, verrichtenden Wesen sind klar gegliedert, experimentell behandelt und in *Pasteur*'schem Geiste erörtert. Die Litteratur ist, wie uns scheint, vollständig berücksichtigt und meistens auf ihren Wert geprüft, auch hat Herr *Duclaux* mehrere eigene, bisher noch nicht veröffentlichte Arbeiten (z. B. über Tyrothrix-Fermentation der Eiweissstoffe, über Milch, Rahm und Butter) in das Buch aufgenommen.

Tome IX. Chimie biologique et physiologique. 2e section: Chimie des végétaux. 1e fascicule: Structure de la plante, par *M Fremy*. 1883. 8°. 156 S.

In diesem Hefte hat Herr *Fremy* seine viele Jahre hindurch fortgesetzten Arbeiten über die Chemie der Pflanzen, besonders über das Skelett der Pflanze und die hauptsächlichsten Veränderungen, welche durch Einwirkung der Fermente im Innern der Zelle vor sich gehen, niedergelegt, Arbeiten, welche grösstenteils bereits Gemeingut der Wissenschaft geworden sind und zum Teil auch, wie die über die verschiedenen Arten der Cellulose und über die Pectinstoffe für die technische Chemie von Bedeutung sind. Auch findet man hier die *Fremy*'schen Ansichten über die Gährung, sowie eine interessante Notiz über die Bildung der Steinkohle.

Engel, R., Nouveaux éléments de chimie médicale et de chimie biologique. 2. édit. 671 p. Paris, Baillère et fils.

Erlenmeyer E., Lehrbuch der organischen Chemie. Red. von O. Hecht. 4 Lfg. 8°. Leipzig, Winter. ℳ 4.

Girardin, J., Leçons de chimie élémentaire appliquée aux arts industriels. 7. édit. T. 3. Chimie organique, principes immediats et industries qui s'y rattachent, matières alimentaires et boissons fermentées avec 330 fig. 8°. 620 p. Paris, Masson. fr. 10.

Graham Otto's Ausführliches Lehrbuch der Chemie; Anorganische Chemie, von *A. Michaelis*. 5. umgearb. Aufl. II. Bd.) 3. Abt. Braunschweig, Vieweg & Sohn, 1863. 640 S. gr. 8°. ℳ 12.

Mit der dritten Abteilung des rüstig seiner Vollendung entgegengehenden grossen Werkes beginnt die Chemie der eigentlichen Metalle. In der vorliegenden ersten Hälfte werden die Alkalimetalle, Kalium, Rubidium, Caesium, Natrium, Lithium, Ammonium, und von den Erdalkalimetallen Calcium und Strontium behandelt. Dem Charakter des Lehrbuchs entsprechend, geht der Einzelbeschreibung dieser Metalle und ihrer Verbindungen eine Einleitung vorauf, welche in übersichtlicher vergleichender Weise die physikalischen und chemischen Eigenschaften zusammenstellt. Diese Zusammenfassung ist für den Lernenden von besonders grossem Nutzen. Auch die Bedürfnisse des Lehrers der Chemie, des Apothekers, des Technikers sind durch Beschreibung von Vorlesungsversuchen, von Methoden zur Darstellung von Präparaten, von industriellen Verfahren, von Prüfungs- und Scheidungsmethoden vollauf berücksichtigt. Auf die neueren Errungenschaften der chemischen Technik ist grösserer Nachdruck gelegt, als in früheren Lieferungen. In Bezug auf die Soda- und Chlorkalkindustrie ist der

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Verf. *Lunge's* vollkommenes Handbuch genügt. Hier und da, wie bei Verarbeitung der Steinkohlen, der Ammoniaksodaindustrie, haben sich frühere Angaben veralteter Verfahren, während manche neuere Erfindungen unserer Ansicht nach hätten erwähnt oder mehr hervorgehoben werden können. Das Alkohol-Ammoniaksoda-Verfahren von *Gossage* z. B. hat sich in der Praxis wegen der Alkali- und Ammoniakverluste nicht bewährt und ist nicht über das Versuchsstadium hinausgekommen; im Schwefelwesen, in der Aufarbeitung der Sodarückstände u. s. w. wären noch einige Neuerungen hervorzuheben gewesen. Wir wollen indess doch nicht vergessen, dass das Buch nicht in erster Linie für den technischen Chemiker, sondern für den mit der reinen Chemie sich Beschäftigenden geschrieben wird, und wollen wiederholt hervorheben, dass wir dasselbe für eine Zierde der deutschen chemischen Literatur halten.

Handwörterbuch, neues, der Chemie. Herausgegeben von *H. v. Fehling*. 43 Lfg. 8°. Braunschweig, Vieweg & Sohn. *M* 2,40.

Hausknecht, O., Lehrbuch der Chemie und chemischen Technologie für Real-Gymnasien etc. 8°. Hamburg, Voss. *M* 4,50.

Hofmann, A. W., Chemische Erinnerungen aus der Berliner Vergangenheit. Zwei akademische Vorträge. 8°. Berlin, Hirschwald. *M* 3.

— Zur Erinnerung an Friedrich Wöhler. 8°. Berlin, Dümmler. *M* 3.

Hoppe-Seyler, F., Handbuch der physiologisch- und pathologisch-chemischen Analyse für Aerzte und Studirende. 5. Aufl. 8°. Berlin, Hirschwald. *M* 14.

Hosaeus, A., Elemente der Chemie. Ein Hilfsmittel für den chemischen Unterricht, insbesondere an Gymnasien. gr. 8°. Leipzig, Quandt & Händel.

Husemann, A., A. Hilger, Th. Husemann, Die Pflanzenstoffe in chemischer, physiologischer, pharmakologischer und toxikologischer Hinsicht. 2. Aufl. 3. Lief. Berlin, Julius Springer. 1883. 8°.*)

Diese Lieferung enthält in früher gerühmter Vollständigkeit in Fortsetzung des Schlusses der vorigen Lieferung noch Beschreibungen von Pflanzenstoffen beschränkter Verbreitung. Erwähnt seien die Familie der Papaveraceae mit den wichtigen Opiumalkaloiden, die Cruciferen, die Umbelliferen mit Coniin, Kümmelöl, Laserpitin u. s. w., sowie die Terebinthineae mit ihren vielen ätherischen Oelen und Harzen.

Jahn, Hans, Die Elektrolyse und ihre Bedeutung für die theoretische und angewandte Chemie. Wien, Hölder. 1883. VIII und 206 S. gr. 8°. *M* 4,40.

Der Herr Verfasser hat bereits früher die chemische Litteratur mit einem kleinen Buche bereichert, welches ganz vortrefflich geeignet ist, den Leser in ein zwar sehr wichtiges, aber meistens ungebührlich vernachlässigtes Gebiet der Chemie einzuführen. Dasselbe entwickelt die Grundsätze der Thermochemie.**) Diesem schliesst sich in der Art der Behandlung die vorliegende Schrift an, welche ein gleichfalls von der theoretischen Chemie nicht genügend occupirtes Gebiet durchmisst. Eine zusammenhängende Theorie der Elektrolyse wird nicht aufgestellt; es dürfte dies bei dem heutigen Zustand der Wissenschaft auch nicht möglich sein. Indessen sieht der Chemiker, von welchem Nutzen die elektrolytischen Vorgänge, im Verein mit den thermochemischen, zur Lösung mancher chemischen Probleme sind. Die Schrift behandelt nach

*) Techn.-chem. Jahrb. 1883. S. 440. **) Ibid. S. 441.

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einem einleitenden Capitel das Faraday'sche elektrolytische Gesetz, die Wanderung der Ionen und die galvanische Endosmose und schliesslich die Zersetzung der wichtigsten chemischen Verbindungen durch den galvanischen Strom. Das elektrolytische Gesetz über die Aequivalenz der durch denselben Strom zersetzten Mengen verschiedener Elektrolyte drückt der Herr Verfasser im Sinne der neueren Chemie so aus: derselbe Strom vermag in gleichen Zeiten eine gleiche Anzahl von Valenzen zu lösen. Das letzte Capitel über die elektrolytische Zersetzung chemischer Verbindungen enthält keine vollständige Aufzählung aller Versuchsdaten; es werden nur die Haupttypen behandelt; allein das reicht völlig hin, um auch die praktische Bedeutung der elektrochemischen Erscheinungen eindringlich zu machen.

Es muss mit Anerkennung hervorgehoben werden, dass der Herr Verfasser sich stets befleissigt, den spröden Stoff in einer Sprache darzustellen, welche bei voller Verständlichkeit auch eine gewisse Eleganz zeigt und niemals ermüdend wird.

Kekulé, A., Lehrbuch der organischen Chemie oder der Chemie der Kohlenstoffverbindungen. Fortgesetzt unter Mitwirkung von *R. Anschütz* und *G. Schultz*. 3. Bd. 4. Lfg. 8°. Stuttgart, Enke. ℳ 3,20.

— Chemie der Benzolderivate oder der aromatischen Substanzen. Fortgesetzt unter Mitwirkung von *R. Anschütz* und *G. Schultz*. 2. Bd. 3. Lfg. 8°. Stuttgart, Enke. ℳ 3,20.

Kolbe, H., Ausführliches Lehr- und Handbuch der organischen Chemie. Zugleich als III., IV. und V. Bd. zu *Graham-Otto's* ausführlichem Lehrbuch der Chemie. 2. umgearb. u. verm. Aufl. von *Ernst v. Meyer*. II. Bd. 1. u. 2. Abt. Braunschweig, Vieweg und Sohn. 1881. 762 S. 8°.

Die erste Lieferung enthält die Geschichte der Polycarbonsäuren, der ungesättigten Kohlenwasserstoffe und der ungesättigten Mono-, Di- und Tricarbonsäuren; sie ist ebenso wie der früher erschienene Band ein sprechendes Zeugnis für die grosse Sorgfalt und den gewissenhaften Fleiss, mit dem der Herr Verfasser eine grosse Aufgabe zu lösen bestrebt ist.

Die zweite Lieferung enthält den Beginn der aromatischen Verbindungen. Wie die früher erschienenen Lieferungen zeichnet sich auch diese durch klare Darstellung, anerkennneswerte Objectivität und, was besonders zu loben, dadurch aus, dass auf noch vorhandene Lücken im chemischen System immer hingewiesen und somit zu neuen Forschungen angeregt wird. Aus dem Inhalt dieser Lieferung heben wir die Betrachtungen über die chemische Constitution des Benzols hervor. Der Verf. stellt es dar als Triacetylen oder als ein Diäthylen, in welchem vier Wasserstoffatome, je eines der vier Methylengruppen, durch das Radical Dimethin ersetzt sind. Diese Anschauung bringt in ungezwungener Weise das Benzol in genetische Beziehung zum Methan, dem Grund- und Eckstein des ganzen Gebäudes der organischen Chemie; sie macht auch die Bildung des Benzols aus dem Acetylen verständlich und vermeidet Sechseck-, Prismen- und andere graphische Formeln, die so viel Verwirrung in der Chemie angerichtet haben.

Die Lieferung enthält die Chemie des Benzols mit seinen Halogen-, Nitro- und Oxyderivaten, der Homologen des Benzols, der aromatischen Alkohole und zum Teil der aromatischen Säuren und Aldehyde.

Kupferschlaeger, J., Analyse pyrognostique des substances minérales. Bruxelles. fr. 3.

Landolt und *Börnstein*, Physikalisch chemische Tabellen. Berlin, J. Springer, 1883. Gr. 8°. 249 S.

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Diese Tabellen, welche mit Ausnahme thermochemischer Daten und für die technische Chemie wichtiger Zahlenangaben wol alle physikalischen Constanten und Reductionszahlen (z. B. für Gasvolumina auf 0°, 760 mm und Trockenheit) enthalten, sind mit einer aussergewöhnlichen Sorgfalt zusammengestellt, zumal ist für jede Tabelle die zugehörige Litteratur angegeben. Ein recht nützliches Verzeichnis der Jahres- und Bandzahlen der wichtigsten physikalischen und chemischen Zeitschriften is anhangsweise hinzugefügt. Ausstattung und Druck sind splendid.

Langhoff, F., Lehrbuch der Chemie, 4. Aufl. 8°. Leipzig, Denicke. ℳ 3,50.

Latschenberger, J., Kurze Anleitung zur qualitativen chemischen Mineralanalyse. Für Mediciner. 8°. Freiburg i. B., Mohr. ℳ 1,80.

Laubenheimer, A., Grundzüge der organischen Chemie. 3. Lfg. 8°. Heidelberg, Winter. ℳ 6.

Lorscheid, J., Lehrbuch der anorganischen Chemie nach den neuesten Ansichten der Wissenschaft. 9. Aufl. 8°. Freiburg i. B., Herder. ℳ 3,60.

Lupton, S., Elementary Chemical Arithmetic. With 1·100 Problems. 12°. 298 p. London, Macmillan. sh. 5.

Mayer, L., Die Lehre von den chemischen Fermenten oder Enzymologie. 8°. Heidelberg, Winter. ℳ 4.

L. Medicus, Kurze Anleitung zur Maassanalyse. Tübingen, H. Laupp, 1883. 8°. 131 S. ℳ 2.

Die Schrift giebt in elementarer Weise einen Abriss der Maassanalyse. Es werden mit kurzen Worten, klar und präcise die Grundbegriffe des Atomgewichts und der Aequivalenz, die Berechnung der Maassanalyse und die zu dieser erforderlichen Instrumente erörtert. Dann werden die Alkali- und Acidimetrie, die Chamäleonanalyse, die Jodometrie und die verschiedenen Fällungsanalysen abgehandelt. In einem Anhange finden wir noch die Bestimmung der Kohlensäure der Luft nach *Pettenkofer*, die Untersuchung der Trink- und Gebrauchswasser und die Harnanalyse. An geeigneten Stellen ist auf die Angaben der Pharmakopoea Germ. ed. altera verwiesen. Das anspruchlose Büchlein kann wegen seiner bündigen Fassung besonders dem Studirenden empfohlen werden.

Meyer, L., Die modernen Theorien der Chemie und ihre Bedeutung für die chemische Mechanik. 4. Aufl. 3. Buch. Dynamik der Atome. 8°. Breslau, Maruschke & Berendt. ℳ 7.

Lothar Meyer und *Karl Seubert*. Die Atomgewichte der Elemente aus den Originalzahlen neu berechnet. Leipzig, Breitkopf & Härtel, 1883. 8° X. u. 275 S.

Die constanten Grössen, auf welche die chemischen Erscheinungen zurückgeführt werden müssen, sind die stöchiometrischen Quantitäten oder die Atomgewichte. Seitdem in neuerer Zeit der Zusammenhang der Atomgewichte mit den physikalischen und chemischen Eigenschaften des Stoffes sich zu erkennen gegeben hat, seitdem man gefunden hat, dass diese Eigenschaften periodische Functionen der Atomgewichte darstellen, haben die letzteren eine weit grössere Bedeutung erhalten, als ihnen früher zukam, so lange sie wesentlich dem praktischen Zweck dienten, bei der Analyse die Zusammensetzung der Körper zu berechnen. Es ist daher ein hoch zu preisendes Verdienst der Herren Verf., diesen wichtigen Constanten, durch Neuberechnung aller bisher gemachten Atomgewichtsbestimmungen den zur Zeit

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möglichst hohen Grad von Genauigkeit gegeben zu haben. Die Abweichungen in den von verschiedenen Chemikern angegebenen Werten der Atomgewichte beruhen nicht allein auf verschiedenen experimentalen Methoden, sondern auch auf der verschiedenen Art der Berechnung, ja Druckfehler haben sich durch Generationen fortgepflanzt. Die HHrn. Verf. sind bei ihren Berechnungen stets auf die ursprünglichen Wägungen zurückgegangen und haben alle möglichen Fehler und Einflüsse in Berücksichtigung gezogen. Auch für die chemische Analyse ist ihre mit so grossem Fleiss und Scharfsinn ausgeführte Arbeit von erheblicher Wichtigkeit. Sie wird dazu beitragen, den eingewurzelten Gebrauch unrichtig bestimmter oder „abgerundeter" Atomgewichte auszurotten; die durch die Anwendung der letzteren begangenen Fehler sind in der That oft viel grösser, als die unvermeidlichen Versuchsfehler. Wird z. B. der Chlorgehalt des Chlornatriums nach dem gebräuchlichen Atomgewichte des Chlors (Cl = 35.5) berechnet, so ergiebt sich 60·684 Proc., während er nach dem wirklichen Atomgewicht Cl = 35·37 nur 60·596 Proc. beträgt. Hier ist der Fehler also beinahe gleich $^1/_{10}$ Proc.

Mills, E. J., Distinctive Distillation. 2 édit. 8°. London, Van Voorst. 3 sh.

Naquet, A., et *M. Henriot*, Principes de chimie fondée sur les théories modernes. 4 édit. 2 vol. 1226 p. Paris, Savy. 11 fr.

Palm, R., Grundriss der qualitativen und quantitativen chemischen Analyse. 8°. Leipzig, Voss' Sortiment. 4 *M.*

Pinner, A., Repititorium der anorganischen Chemie. 5. Aufl. 8°. Berlin, Oppenheim. 7,50 *M.*

Riche, A., Cours de chimie. 2 édit. 306 p. Paris, Germer, Baillière et Co.

Richter, O., Chemical Constitution of the Inorganic Acids, Bases, and Salts, as viewed and interpreted from the standpoint of the Typo-Nucleus-Theory. 8°. 52 p. Edinburgh (London, Simpkin). 3,6 sh.

Richter, M. M., Tabellen der Kohlenstoffverbindungen, nach deren empirischer Zusammensetzung geordnet. Gr. Lex.-8°. 33 Bogen. Berlin, Rob. Oppenheim. 1884. Geh. 11 *M*, geb. 12 *M*.

Dies Nachschlagewerk ist mit einem staunenswerten Fleiss compilirt. Es enthält in seinem ersten Teile eine Zusammenstellung von 15 933 (!) Kohlenstoffverbindungen, deren Formeln und wichtigste Eigenschaften, wie Schmelz- und Siedepunkte, nebst der betreffenden Litteratur angegeben sind. Der zweite Teil, ein Auszug des ersten, giebt eine Zusammenstellung sämtlicher Kohlenwasserstoffe, der dritte bildet ein alphabetisches Register. Diese grosse Anzahl von Verbindungen ist zunächst nach der Anzahl der darin enthaltenen C-Atome gruppirt. Innerhalb dieser Hauptgruppen sind zunächst die C-Verbindungen mit 1 andern Elemente, dann die mit 2, mit 3 u. s. w. anderen Elementen aufgezählt. Die Ordnung dieser Elemente ist H, O, N, Cl, Br, J, S, P; in einer zweiten Gruppe folgen die übrigen Metalloide („Halogene" sagt der Verf. wiederholt), in einer dritten die Metalle, beides in alphabetischer Ordnung. Auf diese Weise sind alle Verbindungen ihrer Bruttoformel nach systematisch geordnet. Der Hr. Verfasser teilt in den etwas unbehülflich gefügten Worten der Vorrede und der Einleitung mit, dass und wie er durch sein Werk das Auffinden einer organisch-chemischen Verbindung erleichtern will, wobei ihn der „Grundgedanke" geleitet hat, „das Unwesentliche, d. h. die wenigen bekannten Verbindungen stets in erster Linie und vollständig hervorzuheben". Nun muss der Ref. bekennen, dass ihm die grosse Arbeit in keinem richtigen Verhältnisse zu diesem Ziele zu stehen scheint. Wenn er sich über eine Verbindung orien-

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tiren will, so zieht er lieber so ausgezeichnete Werke, wie *Beilstein*'s organische Chemie, zu Rate, wo er alles Verwandte beisammen findet, oder auch unsere Jahresberichte und Zeitschriften. Ferner geht es wohl manchem Chemiker so wie dem Ref., der von vielen Verbindungen wol die rationelle Zusammensetzung, d. h. die in zusammengehörige Gruppen oder Radicale geteilte Formel eines Körpers kennt, aber keineswegs die Bruttoformel derselben. Diese muss man erst ausrechnen, und Additionsfehler zu begehen, ist etwas Menschliches. Aber erst nach dieser Rechenoperation kann man das *Richter*'sche Buch benutzen. Wir wollen aber nicht verkennen, dass es für manche Fälle sehr angenehm zu benutzen ist, z. B. um mit einem Blick alle bekannten Isomeriefälle einer Verbindung zu übersehen. Die Litteraturangaben machen das Werk sogar zu einem sehr brauchbaren Hülfsmittel.

Rieth, *R.*, Volumetrische Analyse. Unter Zugrundelegung der in die Pharmacopoea Germanica, Editio altera aufgenommenen Titrirmethoden. Ein Hand- und Lehrbuch für Apotheker und Chemiker. Mit einem Vorwort von Professor Dr. *A. Hilger*. Kl. 8°. IX und 209 S. Leopold Voss, Hamburg und Leipzig 1883. ℳ 3.

Von dem Verf. ist bereits vor einigen Jahren ein ähnliches Werk erschienen (Volumetrie oder chemische Maassanalyse zum Gebrauche im Laboratorium), welches sich die Anerkennung der Fachgenossen in kurzer Zeit erworben hatte. Wie aus dem Vorworte ersichtlich ist, hat *R. Rieth* das vorliegende Werkchen auf Anregung und unter Mitwirkung von Professor *Hilger* und anderen Fachgenossen, welche als Mitglieder der Pharmakopoe-Commission fungirten, ausgearbeitet. Es ist daher nicht zu verwundern, wenn das Büchlein die volumetrischen Arbeiten, welche die neue Pharmakopoe aufgenommen hat, in der gebührendsten Weise berücksichtigt. Der Verf. ist aber noch weiter gegangen und hat auch die gebräuchlichsten und neuesten maassanalytischen Bestimmungsmethoden, welche auf rein chemischem, physiologisch-chemischem oder technisch-chemischem Gebiete angewandt werden, behandelt. Die Schreibweise ist kurz und doch so klar, dass selbst derjenige, welcher bisher keine Gelegenheit fand, sich mit der Maassanalyse zu beschäftigen, sehr gut an der Hand des Buches zu arbeiten vermag. Verf. ging bei Abfassung des Werkchens von dem Princip aus, selbst nicht einmal die elementarsten Dinge als bekannt vorauszusetzen, und entwickelt daher im ersten Teile den Begriff der volumetrischen Analyse, beschreibt die dabei gebräuchlichen Instrumente, die Controle derselben, die Anwendung der Indicatoren, die Anfertigung der Reagenzien im allgemeinen und giebt eine klare Anleitung zur Berechnung der Resultate. Der zweite „systematische" Teil enthält vorerst in alphabetischer Anordnung diejenigen Präparate, deren Prüfung die Pharmakopoe vorschreibt; daran reihen sich einige maassanalytische Methoden der Harn-, Wasser-, Butter-, Fett-, Oel-, Wein-, Bier- und Luftuntersuchung, sowie die Bestimmungsmethoden des specifischen Gewichtes. Der dritte Abschnitt beschreibt endlich die Darstellungen derjenigen Maassflüssigkeiten, welche für die Untersuchung der im zweiten Abschnitt aufgeführten Gegenstände erforderlich sind. B. P.

Ripper, *W.*, Practical Chemistry. With Notes and Questions on Theoretical Chemistry. 8°. 136 p. London, Isbister. sh. 2.

Rivière, *A.* et *Ch.*, Traité de manipulations de chimie. T. 1. 1 fasc. 288 p. Paris, Dunod.

Roscoe, *H. E.*, Chemie. Deutsche Ausgabe, besorgt von *Rose*. 3. Aufl. 16°. Cart. Strassburg, Trübner. ℳ 0,80.

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Roscoe, H. E., und *C. Schorlemmer*, Kurzes Lehrbuch der Chemie nach den neuesten Ansichten der Wissenschaft. 7. Aufl. 8°. Braunschweig, Vieweg & Sohn. ℳ 5,50.

Sbrizziolo, M., Trattato di chimica generale inorganica ed organica. 8°. Neapel, Eschera. L. 12.

Schmidt, E., Ausführliches Lehrbuch der pharmaceutischen Chemie. 2 Bd. Organische Chemie. 3. Abth. 8°. Braunschweig, Vieweg & Sohn. ℳ 9.

Mit dieser Lieferung ist ein sehr verdienstvolles Werk zum Abschluss gelangt. Der Herr Verf. hat nicht einfach eine Beschreibung der pharmaceutischen Präparate und deren Darstellung gegeben, sondern er hat dies überall auf dem Hintergrunde der heutigen wissenschaftlichen Chemie gethan; er hat manche das System derselben erläuternde Körper herangezogen, die keine pharmaceutische Wichtigkeit besitzen; er hat uns ein Lehrbuch der allgemeinen Chemie geliefert, in welchem das pharmaceutisch Wichtige besonders in den Vordergrund tritt. Mit kundiger Hand hat er die Grenze für das theoretisch Wichtige gezogen. Der Apotheker und praktische Chemiker erhält zugleich ein gediegenes Lehrbuch und einen zuverlässigen Führer bei den Laboratoriumsarbeiten.

In dem anorganischen Teile des Werkes (900 S.) sind zunächst die physikalischen und chemischen Eigenschaften der Körper übersichtlich zusammengestellt. Dann folgt die Besprechung der Elemente, wobei immer zunächst das Geschichtliche, denn das Vorkommen, die Darstellung, die Eigenschaften, die Erkennung und die Prüfung erörtert wird. Unter den analytischen Methoden sind die maassanalytischen besonders berücksichtigt; auch die forensisch chemischen Arbeiten sind eingehend abgehandelt. In gleicher wissenschaftlicher Weise ist der organische zweite Teil (1259 S.) des Werkes verfasst. Derselbe steht ganz auf dem Boden der modernen Structurchemie, vermeidet aber jede zu weit gehende nicht genügend von der Erfahrung gestützte Speculation. Nach einer Uebersicht über die chemischen und physikalischen Eigenschaften der organischen Körper und einer Zusammenstellung der wichtigsten Theorien folgen das Methan und dessen Abkömmlinge (die Verbindungen mit offener Kohlenstoffkette), sodann die aromatischen Verbindungen, die mit geschlossener Kohlenstoffkette. Die weiteren Abschnitte sind den ätherischen Oelen, den Campherarten, den Harzen, Gerbstoffen, Flechtensäuren, Pyridin- und Chinolinbasen, sowie den Alkaloiden und schliesslich den Bitterstoffen, Glucosiden, Pflanzen- und Tierfarbstoffen, Eiweisskörpern, leimartigen Stoffen, Gallenstoffen, Humuskörpern gewidmet. Der Untersuchung der Nahrungs- und Genussmittel ist besondere Berücksichtigung zu Teil geworden. Von der Illustration ist ein discreter Gebrauch gemacht, aber viele Originalzeichnungen, besonders von mikroskopischen Präparaten zeigen, dass auch hier dieselbe Sorgfalt wie beim Text gewaltet hat.

Schützenberger, P., Traité de chimie générale, comprenant les principales applications de la chimie aux sciences biologiques et aux arts industriels. T. 3. Paris, Hachette & Co. fr. 10.

Schwanert, H., Lehrbuch der pharmaceutischen Chemie. 2 Bd. 4 Lfg. 8°. Braunschweig, Schwetschke & Sohn. ℳ 3.

Sibson, A., Every-Day Chemistry. New edit. 12°. London, Routledge. sh. 1,6.

Städler, G., Leitfaden für die qualitative chemische Analyse anorganischer Körper. 8. Aufl., ergänzt von *H. Kolbe*. 8°. Zürich, Orell, Füssli & Co. ℳ 1,60.

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Thomsen, J., Thermochemische Untersuchungen. 2 Bd. Metalloide. 8°. Leipzig, Barth. ℳ 12.

Ward, G. M., A Compend of Chemistry. Adapted for the use of Physicians and Students. 12°. Philadelphia. sh. 5.

Wehner, Leitfaden der Chemie mit besonderer Berücksichtigung der landwirtschaftlichen Gewerbe. 8°. Berlin, Parey. ℳ 5.

Wenghöffer, L., Lehrbuch der anorganischen reinen und technischen Chemie auf Grundlage der neuesten Forschungen und der Fortschritte der Technik. Konrad Wittwer in Stuttgart. 1. Abt. 8°. 302 S. ℳ 5.

Der Herr Verf. hat in Rücksicht darauf, dass die meisten studirenden Chemiker nach Beendigung ihrer Studien sich der Anwendung der Chemie in der Technik widmen, in seinem Lehrbuch einen besonderen Nachdruck auf die Beschreibung der praktischen Verwertung der chemischen Lehren gelegt. Hierdurch unterscheidet sich sein Buch höchst vorteilhaft von zahlreichen ähnlichen kurzen Lehrbüchern. Dabei wird die rein wissenschaftliche Seite des Lehrstoffs durchaus nicht vernachlässigt, sondern in einer Weise vorgetragen, die den erfahrenen Lehrer erkennen lässt. Nach Behandlung der Metalloide und ihrer Wasserstoff- und Halogenverbindungen werden die heutigen Theorien kurz dargestellt; erst dann folgt die Beschreibung der Sauerstoffverbindungen der Metalloide. Die einzelnen Körper werden zunächst in ihren Eigenschaften, dann nach ihren Anwendungen, darauf in ihrem Vorkommen und schliesslich in ihrer Gewinnung besprochen. Da das Vorkommen eines Körpers von fundamentaler Bedeutung für seine Anwendung ist, so möchte es vielleicht besser sein, dasselbe vor den „Anwendungen“ aufzuführen. Der Herr Verf. hat im Ganzen dem neuesten Stande der Technik Rechnung getragen, deshalb auch die Patentlitteratur berücksichtigt. Citate sind nicht angegeben, obgleich die Quellen oft recht wörtlich benutzt worden sind. So haben wir z. B. die nicht gerade schöne Phrase, „die Steinkohle, der bedeutsamste Brennstoff“, schon in einem bekannten Lehrbuch der chemischen Technologie gefunden. Sehr zu loben ist es, dass der Herr Verf. auch statistische Angaben macht, auf die in den weitaus meisten kürzeren Lehrbüchern niemals Rücksicht genommen wird. Und doch ist es so wichtig, dass bereits der Studirende eine Anschauung von der wirtschaftlichen Bedeutung einer chemischen Industrie für dieses oder jenes Land erhalte.

Wenghöffer, L., Die wichtigsten Forschungsresultate auf dem Gebiete der Chemie der Kohlenstoff-Verbindungen, 1882, Stuttgart, Konrad Wittwer. 8°. 64 S. ℳ 1,20.

Das Heft ist zunächst ein Nachtrag zu des Herrn Verf.'s Lehrbuch der Chemie der Kohlenstoffverbindungen. Das, was mitgeteilt ist, hat derselbe klar vorgetragen. Ueber die Auswahl des Stoffes und die Hinweglassung mancher Arbeit wollen wir mit dem Verf. nicht rechten, da die Ansichten über die Wichtigkeit der Forschungen ja verschieden sein können, und wir das Lehrbuch, zu welchem dies Heft ein Appendix sein soll, nicht kennen. Litteraturangaben sind beigefügt. Manchem möchte die bündige Darstellung recht willkommen sein.

Wilson, G., Inorganic Chemistry. Revised and enlarged by H. G. Madan 8°. 530 p. London, Chambers. 4 sh.

Winkler, Clemens, Die Maassanalyse nach neuem titrimetrischen System. Freiberg, J. G. Engelhardt, 1883. 8°. 98 S. ℳ 4.

Der Herr Verf. hat ein System der Maassanalyse auf der Basis der

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modernen Molecularformeln aufgebaut und damit „das auf die veraltete dualistische Anschauung zugeschnittene titrimetrische System“ verlassen, d. h. die Valenz der Lösungen wird nicht, wie gewöhnlich, nach den einem Atom Wasserstoff, sondern nach den einem Molecul Wasserstoff äquivalenten Mengen hergestellt. Infolge dessen ist die Concentration der Normallösungen doppelt so gross wie die der gewöhnlich gebrauchten: auch werden dieselben in der Regel als $^1/_{10}$ normale verwendet. Es liegt hierin gewiss eine unbestreitbare Logik, man hat nicht nötig, „halbe Molecule“ aufzulösen, man braucht keinen Vorbehalt zu machen, um die Titrirmethode in unser molecularchemisches System einzureihen. Allein, auch das von einem Atom Wasserstoff ausgehende Titrirsystem ist consequent, vor allem, es ist überall eingebürgert, und es will uns nicht unbedenklich erscheinen, hier Neuerungen einzuführen, die leicht Verwirrungen hervorrufen können. Wenn wir der Einführung dieser Neuerung nicht das Wort reden können, so haben wir uns umsomehr mit der Art befreundet, wie der Herr Verf. seinen eigentlichen Lehrstoff behandelt. Die Anleitungen zum Gebrauch der Apparate und zur Ausführung der Maassanalysen können nicht besser gegeben werden. Dass der ausgezeichnete Lehrer an der Freiberger Bergakademie besonderen Nachdruck auf die Analyse unorganischer und metallurgischer Stoffe legt, ist begreiflich und giebt seiner Anleitung für manche Kreise einen besondern Wert. Ein Anhang enthält noch u. a. Tabellen über die Mengen Substanz, die abgewogen werden müssen, wenn 1 cbcm $^1/_{10}$ Normallösung = 1 Proc. des gesuchten Bestandteils sein soll (in dieser Tabelle sind bei Bariumoxyd die dem Bariumsuperoxyd zukommenden Zahlen angegeben), ferner über Dichtigkeiten einiger Säuren und über Baumé's Aräometerscala.

Woodward, *C. J.*, Arithmetical Chemistry; or Arithmetical Exercises for Chemical Students. Part 1. Elementary. 12°. 44 p. Birmingham. London, Simpkin. 1 sh.

Zaengerle, *M.*, Grundriss der Chemie und Mineralogie nach den neuesten Ansichten der Wissenschaft. Braunschweig, Vieweg & Sohn.

Zeller, Précis élémentaire de physique et de chimie. 10 édit. 400 p. Paris, Vve Belin et Fils.

III. Chemische Technologie.

Andès, *E.*, die Fabrikation der Lacke, Firnisse, Buchdrucker-Firnisse und des Siegellacks. 3. Aufl. 8°. Wien, Hartleben. *M* 3.

Andès, *L. E.*, die Fabrikation der Copal-Terpentinöl- und Spiritus-Lacke. 8°. Wien, Hartleben. *M* 6,20.

Annuario della R. Scuola superiore d'Agricoltura in Portici. Napoli 1883.

Der vom Herrn Verf. freundlichst eingesendete Band enthält: ***Eustachio Mingioli***, Monografia sull' analisi immediata delle Olive ovvero le sostanze grasse e loro posto anatomico nella drupa dell' ulivo. Gr. 8°. 164 S.

In der Schrift sind sehr eingehende Studien über die Fettstoffe in den verschiedenen Teilen der Olive, dem Epicarpium, Sarkocarpium, Endocarpium und dem Kern der Frucht niedergelegt. Untersucht wurden drei Varietäten der Olive: Nostrali (Olea europoea atrocirens), Tarantine (Olea eur. atrorubens), Gnannare (Olea eur. oblonga). Die Resultate der Untersuchung sind auch nicht ohne technische Bedeutung.

Bauermann, *H.*, a Treatise on the Metallurgy of Iron. 5 edit. 522 p. London, Lockwood. sh. 5.

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Becke, W. v. der, die Milchprüfungs-Methoden. 8°. Bremen, Heinsius. *M* 2,80.

Bertsch, J., die Verwertung des Holzes auf chemischem Wege. 8°. Wien, Hartleben. *M* 4,50.

Biechele, M., Anleitung zur Erkennung und genauen Prüfung aller in der neuen Auflage der deutschen Pharmakopöe aufgenommenen Stoffe. 4. Aufl. 12°. Eichstätt, Stillkrauth. *M* 2.

Bird, F. J., the American Practical Dyers Companion; including 500 Receipts. Illustrated by samples of dyed raw materials and fabrics. 8°. London, Low & Co. sh. 42.

Birnbaum, K., die Prüfung der Nahrungsmittel und Gebrauchsgegenstände im Grossherzogthum Baden. 8°. Karlsruhe, Braun. *M* 2,80.

Bloxam, C. L., Metals: their Properties and Treatment. New edition, partially re-written and augmented by *Alfr. K. Huntington*. 12°. 452 p. London, Longmans. sh. 5.

Böckmann, Fr., chemich-technische Untersuchungsmethoden der Gross-Industrie, der Versuchsstationen und Handelslaboratorien. Unter Mitwirkung von *C. Balling, M. Barth, C. Bischof, E. Büchner, P. Jeserich, C. Kretzschmar, O. Mertens, A. Morgen, J. Nessler, R. Nietzki, E. Scheele, A. Stutzer* herausgegeben von Dr. *Fr. Böckmann*. 2 Bde. 753 S. *M* 16.

Auf unseren Hochschulen wird wol niemals ein Chemiker so ausgebildet, dass er in allen analytischen Verfahren zu Hause ist und beim Eintritt in die Praxis, in die chemische Fabrik, wo schnell und sicher gearbeitet werden muss, wenn nicht der ganze Betrieb Störungen erfahren soll, gleich die richtigen Untersuchungsmethoden benutzt. Selbst wenn auf der Hochschule Zeit für ein so detaillirtes analytisches Studium erübrigt werden könnte, was nicht der Fall ist, so würde er dennoch nicht alle die analytischen Verfahren, Hülfsmittel und Fertigkeiten sich aneignen können, denn diese sind das Product langjähriger Erfahrungen und unausgesetzter Beschäftigung mit einem und demselben Gegenstand, wie sie sich eben in einem Specialbetrieb herangebildet haben, die aber der Lehrer an einer Hochschule, der ein weites Gebiet zu übersehen hat, nicht völlig erringen und weiter mitteilen kann. So steht denn häufig der junge Chemiker beim Eintritt in die Fabrik ratlos da. Hier nun findet er einen treuen Führer in Herrn *Böckmann*'s chemisch-technischen Untersuchungsmethoden. Denn die einzelnen Teile dieses Buches sind von Chemikern verfasst, die mitten in der Praxis und auf der Höhe ihres Specialfaches stehen. Aber nicht nur hat der in die chemische Technik Eintretende hier ein gutes Lehrbuch, sondern auch dem erfahrenen praktischen Chemiker wird ein völlig zuverlässiges Nachschlagebuch geboten. Da die einzelnen Zweige der chemischen Industrie so viele Berührungspunkte mit einander haben und deren täglich neue erhalten können, so ist es notwendig, rasch sich die Kenntnis der jedem Zweige eigentümlichen analytischen Verfahren verschaffen zu können. Es leuchtet daher ein, dass ein Buch, wie das *Böckmann*'sche, wenn es gut gearbeitet ist, in der That einem vielseitig empfundenen Bedürfnis entsprechen wird.

Dass dies Buch seine Aufgabe in vollem Maasse löst, wird jeder beim Durchstudiren und noch mehr bei Benutzung desselben im Laboratorium mit Wohlgefallen wahrnehmen. Der Herr Herausgeber hat in einem ersten

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allgemeinen Teil seine Ansichten und Erfahrungen über technische Analysen, zumal Maassanalyse, über die Hülfsmittel und den Apparat derselben, die Aufstellung und Berechnung der Analysen, die Einrichtung der Fabriklaboratorien, die äussere Stellung der Fabrikanalytiker etc. niedergelegt. Jeder technische Chemiker sollte sich mit diesem Abschnitt, der eine Fülle beherzigenswerter Ratschläge enthält, vertraut machen. In dem zweiten speciellen Teil sind die Fabricationszweige der eigentlichen sog. chemischen Grossindustrie, Schwefelsäure, Sulfat, Soda, Sodarückstand, kaustische Soda, Salpetersäure, Chlorkalk, Potasche, Kalisalpeter, ferner die Explosivstoffe von Herrn *Böckmann*, Chemiker der Solvay'schen Sodafabrik in Wyhlen, bearbeitet, Handelsdünger von Herrn *E. Scheele*, Dirigenten der Ohlendorff'schen Düngerfabrik in Emmerich, Teerfarben von Herrn *R. Nietzki*, Chemiker der Kalle'schen Anilinfarbenfabrik in Biebrich, Ultramarin von Herrn *E. Büchner* in Pfungstadt, Thonanalyse von Herrn *C. Bischof* in Wiesbaden, der ersten Autorität auf diesem Gebiete, Glas, Kalk und Cement (könnte etwas ausführlicher sein), Brennkohlenmaterialien, Steinkohlengas, Eisen von Herrn *Böckmann*, die übrigen Metalle von Herrn *C. Balling*, Prof. an der Bergakademie in Pribram, Zucker von Herrn *Böckmann*, Bier von Herrn *O. Mertens*, Handelschemiker in Köthen, Wein von Herrn *J. Nessler* und Herrn *M. Barth* in Karlsruhe, Branntwein, Liqueure, Essig von Herrn *Mertens*, Fette von Herrn *Böckmann*, Seife von Herrn *Mertens*, Futterstoffe von Herrn *A. Stutzer*, Vorsteher der agriculturchemischen Versuchsstation in Bonn, Nahrungsmittel von Herrn *Mertens* (für Milch und Butter nicht eingehend genug), Luft von Hrn. *Böckmann*, Wasser von Hrn. *Mertens*, Bodenanalyse von Hrn. *A. Morgen*, Assistent an der Versuchsstation zu Halle, Harnanalysen (sehr kurz), Gerichtlich-chemische Untersuchungen von Herrn *Jeserich*, Chemiker der Berliner Gerichte. Diesem reichen Inhalt ist noch ein Honorartarif und eine Tabelle mit Factoren für analytische Berechnungen angefügt. Der beschränkte Raum verbietet es uns, die einzelnen Aufsätze näher zu besprechen. Wenn wir vielleicht auch einige nebensächliche Dinge etwas anders gemacht haben würden, so sind wir doch überzeugt, dass das Buch ein überaus nützliches Werk ist und verdient in die weitesten Kreise zu gelangen.

Brown, J. T., Photometry and Gas Analysis. 8°. 112 p. London, Scientific Publishing Co. sh 4.

Brown, W. L., Manual of Assaying Gold, Silver, Copper and Lead Ores. Chicago sh 9.

Cohn, W., Die käuflichen Düngemittel, ihre Darstellung und Verwertung. 8°. Braunschweig, Vieweg & Sohn. ℳ 1,20.

Cornut, E., Etudes sur le pouvoir calorifique des houilles. In-8°. 28 p. et 6 tableaux, Paris, impr. Capiomont et Renault.

D'Achiardi, A., i metalli, loro minerali e miniere. 1 Bd. Gr.-8°. 402 p. Mailand, Hoepli ℳ 6,40.

Dahm, G., Tafeln zur schnellen Ermittelung des Alkoholgehaltes geistiger Flüssigkeiten nach Gewichtsprocenten bei der Destillationsmethode. 8°. Wiesbaden, Kreidel ℳ 0,60.

Dawidowsky, F., Die Leim- und Gelatine-Fabrikation. 2. Aufl. 8°. Wien, Hartleben. ℳ 3.

Delafond, Note sur la fabrication de l'acier au moyen de fontes phosphoreuses aux usines de Creuzot. In-8°. 27 p. Paris, Dunod.

Dietzsch, Oscar, Die wichtigsten Nahrungsmittel und Getränke, deren Ver-

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unreinigungen und Verfälschungen. Vierte gänzlich umgearbeitete und vermehrte Auflage. Zürich, Orell Füssli & Co. 1884. 8°. 352 S.

Unter den vielen auf Nahrungsmittel und deren chemische und mikroskopische Untersuchung bezüglichen Werken, welche in den letzten Jahren veröffentlicht worden sind, ist das von Hrn. *Dietzsch* eines der besten. Gegenüber der dritten Auflage hat die jetzige durchgreifende Veränderungen erfahren und ist um $^1/_3$ stärker geworden, dank der grossen Thätigkeit der Analytiker auf dem Gebiete der Nahrungsmittel und Gebrauchsgegenstände. Der Verfasser, Cantonschemiker des Cantons Zug und Chemiker der weltbekannten Fabrik condensirter Milch zu Cham, hat die beschriebenen Methoden alle selbst geprüft, und seinem Urteil ist kein geringer Wert beizulegen. Er hat die meisten Untersuchungsverfahren abgehandelt, auch die physikalischen Eigenschaften, Volumgewicht u. s. w. der betreffenden Stoffe sind mit Sorgfalt angegeben. Nur die mikroskopische Untersuchung scheint uns nicht gebührend berücksichtigt zu sein. Ein Blick durch das Mikroskop lehrt oft in kürzester Frist erkennen, was die chemische Analyse erst nach vielen Mühen oder auch garnicht zeigt. Bei den wichtigeren Stoffen sind zwar die mikroskopischen Kennzeichen angegeben; allein eine grössere Ausführlichkeit und häufigere Anwendung der Illustration würde auch hier dem Buche zum Vorteil gereicht haben. In chemischer Beziehung wird jeder Hygieniker und Chemiker einen vortrefflichen Führer in dem Buche haben. Wir halten es auch für wohl geeignet, als Grundlage zu dienen für eine allgemeine Vereinbarung über die anzuwendenden Untersuchungsmethoden. Es ist dies ein Desiderium, welches im Interesse der öffentlichen Gesundheitspflege und des Handels möglichst bald erfüllt werden sollte.

Dokowicz, F., Recepte für Bierbrauerei, Hefen- und Essigfabrikation. 8°. Halle, Knapp. ℳ 3.

Dürre, E. F., Die Anlage und der Betrieb der Eisenhütten. 15.—17. Lfg 4°. Leipzig, Baumgärtner. ℳ 6.

Elsner, Fr., Die Praxis des Nahrungsmittel Chemikers. 2. vermehrte Aufl. 1882. 8°. 216 S. Hamburg und Leipzig, Leop. Voss. ℳ 5.

Dieses Buch kann den Apothekern und Hygienikern warm empfohlen werden. Es ist diesen bei Untersuchungen von Luft, Wasser, Boden, von Nahrungsmitteln und Gebrauchsgegenständen ein höchst zuverlässiger Führer. Der Herr Verfasser hat manches darin aufgenommen, auf die Handhabung der Apparate Bezügliches u. dgl., was dem erfahrenen Chemiker vertraut ist; aber für diejenigen, die erst mit hygienischen Untersuchungen beginnen, oder die, wie viele Apotheker, nur selten in die Lage kommen, solche auszuführen, sind derartige Fingerzeige sehr am Platze; sie werden den Chemiker sicher vor Missgriffen bewahren. Der Inhalt des Buches ist sehr vollständig, mit den erforderlichen Tabellen und mit schönen Abbildungen versehen. Bei Petroleum vermissen wir allerdings die genaue Beschreibung und Abbildung des amtlichen Petroleumprüfers. Als ein kleines Monitum wäre noch anzuführen, dass bei den Litteraturnachweisen statt der „Chem.-techn. Mittheil." oder ausser diesen auch die Originalstellen hätten angegeben werden müssen. Bemerkenswert ist die Einleitung, welche von dem Beruf und der Stellung des Nahrungsmittel-Chemikers handelt.

— Recepte für Pharmacie und chemische Grossindustrie. 8°. Halle, Knapp. ℳ 2,40.

Emmerling, A., Zusammenstellung von Wasser-Analysen, als Beitrag zu einer Wasser-Statistik Schleswig-Holsteins. 8°. Kiel, Haeseler. ℳ 1,60

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Fleck, H., Ueber Flammensicherheit und Darstellung flammensicherer Gegenstände. 8°. Dresden, v. Zahn. ℳ 1.

— Die Analyse des Weines in ihrer Bedeutung für die Weinindustrie. 8°. Dresden, v. Zahn. ℳ 1.

Folkard, C. W., Potable Water and the relative efficiency of different methods of detecting impurities. New-York. sh. 2,6.

France, Ch. de, Etudes sur l'extraction par voie humide du cuivre, de l'argent et de l'or. In-12°. 251 p. avec fig. fr. 5.

Frankland, P. F., Agricultural Chemical Analysis. Founded upon „Leitfaden für die agriculturchemische Analyse von *F Krocker*". 320 p. London, Macmillan. sh. 7,6.

Gaillet et *Huet*, Epuration des eaux de vidange des fabriques avec utilisation des résidus. Lille, impr. Danel.

Gillet, A., Traité pratique du dégraissage et du blanchiment des tissus, des toiles, des écheveaux, de la flotte, enfin de toutes les matières textiles, ainsi que du nettoyage et du détachage des vêtements et teintures. Paris, Baudry.

Grandeau, L., Traité d'analyse des matières agricoles. 2 édit. 836 p. Paris, librairie de la Maison rustique. fr. 12.

Gressler, E., Anleitung und Recepte zur Anfertigung aller Arten Luxusgetränke mittelst Mineralwasser-Bereitungs-Maschinen u. s. w. 2. Aufl. 8°. Halle, Hofstetter.

Grouven, H., Vorträge über Agricultur-Chemie mit besonderer Rücksicht auf Tier-Physiologie. 2. Bd. 3. Aufl. 8. Cöln, Hassel. ℳ 13,50.

Habich's, G. E., Schule der Bierbrauerei. 4. Aufl. 4—6. Abt. 8°. Halle, Knapp. ℳ 3.

Inhalt: Würzebereitung, das Gährungsverfahren und die Kellerwirtschaft. Herausgegeben von *C. Schneider* und *G. Behrend.*

Hampe, W., Ueber die Analyse der Sprengstoffe. 4°. Ernst & Korn. ℳ 1,50.

Handbuch der chemischen Technologie. Herausgegeben von *P. A. Bolley*, fortgesetzt von *K. Birnbaum.* 6 Bde. 4. Gruppe, 2. Abth. 8°. Braunschweig, Vieweg & Sohn. ℳ 8.

Inhalt: Fabrikation der Kautschuk- und Guttapercha-Waaren. Von *Ch. Heinzerling.*

Hellriegel, H., Beiträge zu den naturwissenschaftlichen Grundlagen des Ackerbaues. 8°. Braunschweig, Vieweg & Sohn. ℳ 22.

Hoffer, R., Practical Treatise of Caoutchouc and Gutta-Percha. 12°. London, Low. sh. 12,6.

Hoffmann, F., and *D. B. Power*, A Manual of Chemical Analysis as applied to the Examination of Medicinal Chemicals. 3 edit. Roy-8°. 620 p. London, Churchill. sh. 18.

Hooper, Egbert G., The Manual of Brewing. Scientific and Technical. 2 edit. London, Sheppard and St. John. sh. 5.

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Horsin-Déon, P., Traité théorique et pratique de la fabrication du sucre, guide du chimiste-fabricant. 640 p. Paris, Bernard & Co.

Japing, E., Die Elektrolyse, Galvanoplastik und Reinmetallgewinnung. 8°. Wien, Hartleben. ℳ 3.

— Kupfer und Messing, sowie alle technisch wichtigen Kupferlegirungen, ihre Darstellungsmethoden, Eigenschaften und Weiterverarbeitung zu Handelswaaren. 8°. Wien, Hartleben. ℳ 3.

Johnston, J. F. W. and *C. A. Cameron*, Elements of Agricultural Chemistry and Geology. 13. édit. 516 p. London, Blackwoods. sh. 6,6.

Kerl, B., The Assayers Manual: an abridged Treatise on the Docemastic Examination of Ores, and Furnace and other artificial Products. Translated from the German by *W. T. Brant* and edited by *W. H. Wahl*. 8°. Philadelphia. sh. 15.

Koenig, J., Die menschlichen Nahrungs- und Genussmittel, ihre Verfälschungen und deren Nachweisung; mit einer Einleitung über die Ernährungslehre. Zweite sehr vermehrte und verbesserte Auflage. 8°. XVIII und 820 S. Berlin, Jul. Springer 1883.

Schon die erste Auflage dieses vortrefflichen Werkes hatte den ersten Rang in der reichen Literatur über Nahrungs- und Genussmittel eingenommen. Seit Erlass des Nahrungsmittel-Gesetzes vom 14. Mai 1879 und seit Creirung des Reichsgesundheitsamtes ist das Interesse für diese Gegenstände in die weitesten Kreise gedrungen und in Folge dessen ist in kurzer Frist eine zweite Auflage von *Koenig*'s Buch notwendig geworden. Der Herr Verfasser hat dieselbe völlig auf die Höhe unserer heutigen Kenntnisse gebracht, und das erheblich stärker gewordene Volumen des Werkes ist auch ein Zeichen dafür, mit welchem Eifer auf diesem Felde gearbeitet wird. In Anbetracht der grossen Verbreitung der ersten Auflage ist es nicht nötig, hier nähere Mitteilungen über den Inhalt des Buches zu machen; wir wollen nur nachdrücklich hervorheben, dass es nicht nur dem Arzt und Chemiker ein stets zuverlässiger Führer ist, sondern wegen seiner einfachen Diction auch eine reiche Quelle der Belehrung für den Laien, der sich über das wichtige Capitel der menschlichen Ernährung unterrichten will.

Koppe, S. W., Das Glycerin. Seine Darstellung, seine Verbindungen und Anwendung in den Gewerben, in der Seifenfabrikation, Parfumerie und der Sprengtechnik. 8°. Wien, Hartleben. ℳ 2,50.

Lebeaud, J. J. de Fontenelle et *F. Malepeyre*, Nouveau manuel complet du distillateur liquoriste, etc., suivi de la fabrication des alcoolates employés en parfumerie et préparés par le liquoriste. 460 p. Paris, Roret. fr. 3,50.

Ledebur, A., Handbuch der Eisenhüttenkunde. 1. Abt. 8°. Leipzig, Felix. ℳ 10.

— Vollständiges Handbuch der Eisengiesserei. 8° mit Atlas in 4°. Weimar, B. F. Voigt. ℳ 13,50.

Leplay H., Chimie théorique et pratique des industries du sucre. 1 vol. T. 1. 452 p. Paris, Baudoin & Co. fr. 8.

Lippmann, Edm. O. von. Die Zuckerarten und ihre Derivate. Vom Vereine für die Rübenzucker-Industrie des Deutschen Reiches mit dem ersten

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Preise gekrönte Monographie. Braunschweig, F. Vieweg & Sohn. 1882. 8°. 233 S. *M* 6.

Dies ist eine sehr empfehlenswerte Schrift, welche eine erschöpfende Beschreibung der chemischen und physikalischen Eigenschaften sämtlicher Zuckerarten darbietet. Der Hr. Verfasser, durch zahlreiche Arbeiten auf dem Gebiete der Zuckerchemie vorteilhaft bekannt, hat mit grosser Gewissenhaftigkeit und in klarer übersichtlicher Darstellung die vielen in technischen und wissenschaftlichen Zeitschriften zerstreuten Angaben über den Zucker in einer Monographie zusammengestellt, welche nicht nur geeignet ist, den Zuckertechniker mit allem Wichtigen über die Eigenschaften, die Nachweis- und Bestimmungsmethoden der in seiner Industrie vorkommenden Körper bekannt zu machen, sondern auch dem wissenschaftlichen Forscher eine belehrende Uebersicht über die Zuckerchemie darbietet und ihn zu ferneren Untersuchungen veranlassen wird.

Lock, C. G. W., W. G. Wagner and *R. H. Harland*, sugar growing and refining; a comprehensive treatise on the culture of sugar yielding plants and the manufacture, refining and analysis of cane, beet, maple, melon, milk, palm, sorghum and starch sugars etc. 8°. 766 p. London, Spons. Sh. 30.

Lunge, G., Taschenbuch für die Soda-, Potasche- und Ammoniak-Fabrikation. Herausgegeben im Auftrage des Vereins Deutscher Sodafabrikanten unter Mitwirkung mehrerer Mitglieder. Berlin, J. Springer. 1883. 194 S.

Dieses sehr praktisch eingerichtete Hülfsbuch zerfällt in einen allgemeinen und einen speciellen Teil. Der erstere enthält zunächst eine Atomgewichtstabelle, welche im allgemeinen „abgerundete" Atomgewichte giebt. Für Platin ist statt 194·46 das ältere Atomgewicht 197·18 gegeben, da dieses von den deutschen Kalisalzfabrikanten allgemein angenommen wird. Dann folgen die Formeln, Moleculargewichte und procentische Zusammensetzung einer Anzahl von Verbindungen, Factoren zur Berechnung von Analysen; sodann Löslichkeitstabellen, Angaben über specifische Gewichte, über Ausdehnung und Wärme, mathematische Zahlen, Maasse, Gewichte (auch von Metallblechen, Quadrat- und Rundeisen und Röhren), Münzen und schliesslich Auszüge aus dem Patent- und dem Haftpflichtgesetz. Der specielle Teil enthält viele neue Berechnungen und originale Angaben; er ist wesentlich den analytischen Verfahren gewidmet, welche bei Untersuchuug der Roh-, Zwischen- und Endproducte, sowie der Rückstände in der chemischen Grossindustrie einzuschlagen sind. Der Inhalt bezieht sich auf Brennmaterial und Feuerungen, Schwefelsäurefabrikation, Sulfat- und Salzsäuredarstellung, Chlorkalk, Sodafabrikation, Schwefelregeneration, Fabrikation von Salpetersäure, Potasche, Ammoniak, und schliesslich werden Vorschriften zur Bereitung von Normallösungen und für die so wichtige Operation des Ziehens von Durchschnittsmustern. Das Taschenbuch wird seines reichen Inhalts und der trefflichen Anordnung wegen den Weg in alle Fabriklaboratorien finden, und besonders der zweite Teil wird zur Erreichung des langersehnten Ziels, der Einführung einheitlicher Untersuchungsmethoden, wesentlich beitragen.

Lunge, G., a Treatise on the Distillation of Coal Tar and Ammonical Liquor, and the separation from them of valuable products. 8°. 374 p. London, Van Voorst. Sh. 21.

Maercker, M., über die Verluste der Diffusionsrückstände der Zuckerfabriken beim Lagern. 8°. Berlin, Parey. *M* 2.

Meyer, Rich., Die künstlich erzeugten organischen Farbstoffe. Neuere Ent-

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wickelung der Teerfarbenindustrie. (Bolley's Technologie.) Braunschweig, Vieweg & Sohn, 1883. 231 S. Gr. 8°. ℳ 5,60.*)

Diese Lieferung behandelt das synthetisch dargestellte Indigblau, gewisse Naphtalinderivate und die sogenannten Indophenole. Die 117 Seiten umfassende Beschreibung der Chemie des Indigblaus und der verwandten Körper ist wol die vollständigste Monographie, die wir über diesen Gegenstand besitzen. Jedoch vermissen wir bei der Discussion der Constitutionsformeln, welche den Körpern der Indigogruppe zuzuschreiben sind, die Erwähnung der Einwürfe, welche Herr *Kolbe* gegen die von Herrn *Baeyer* herrührenden Formeln erhoben hat. Im allgemeinen gelten auch von dieser Lieferung die an den früheren gerühmten Vorzüge. Die Zeitschriften- und Patent-Litteratur ist in gewissenhaftester Weise benutzt und citirt worden.

Michel, C., Lehrbuch der Bierbrauerei nach dem neuesten Standpunkte der Wissenschaft und Praxis, unter Zugrundelegung eigener Versuche und Erfahrungen. 3 Bd. 1 Heft. München. Leipzig, Gracklauer. ℳ 6.

Mills, E. J., Destructive Distillation: a Manualette of the Paraffin, Coal, Tar, Resin, Oil, Petroleum and kindered Industries. 2 edit. 8°. 80 p. London, Van Voorst. Sh. 3.

Moermann, Notice sur l'électro-métallurgie ou extraction économique et rapide des métaux précieux, de leurs minerais, basé sur l'emploi de l'électricité pour tout faire. In-8°. 43 p. Bruxelles. Frcs. 2.

Morgan, C. L., Water: its Teachings in Chemistry, Physics and Physiography 18°. London, Stanford. Sh. 2,6.

Moyret, M., Traité de la teinture des soies. 8°. Basel, Georg. ℳ 16.

Neubauer, C. und *J. Vogel*, Anleitung zur qualitativen und quantitativen Analyse des Harns. 8. Aufl. 2. Abt.: Semiotischer Teil. Bearbeitet von *L. Thomas*. 1. Hälfte. 8°. Wiesbaden, Kreidel. ℳ 1,60.

Peligot, Eug., Traité de Chimie analytique appliquée à l'Agriculture. Paris, G. Masson, 1883. 8°. 551 S.

Der Herr Verf. hat ein Werk geschaffen, welches für den Landwirt und alle diejenigen, welche mit den Erzeugnissen des Ackerbaus, des Weinbaus und der Viehzucht zu thun haben, von grossem Nutzen ist. In der Einleitung wird der Wert und die Bedeutung der analytischen Chemie nach den verschiedensten Richtungen hin erläutert. Eine dann folgende Tabelle enthält die Aequivalente und Atomgewichte der Elemente. Weshalb hierbei Magnesium mit dem Atomgewicht 12 neben den übrigen Elementen, deren Atomgewicht gleich der Aequivalentzahl ist, aufgeführt wird, ist nicht ersichtlich. Nach einem Capitel über die Reagentien, deren Bereitung und Aufbewahrung, ein Capitel, das manches Beherzigenswerte für den Chemiker enthält, folgt die bündige Beschreibung der qualitativen Bestimmung der für den Agriculturchemiker wichtigsten Basen, Mineral- und organischen Säuren. Eine besondere Abhandlung der quantitativen Analyse, die man jetzt wol erwarten würde, findet sich nicht; es folgt jetzt der interessantere Teil des Werkes, der sich speciell mit den einzelnen agriculturchemisch wichtigen Körpern, und auch mit deren quantitativer Analyse, beschäftigt. Zunächst wird die Analyse der Ackererden, der Kalksteine, Thone und Cemente erörtert. Den Anfang dieses Capitels bildet die so wichtige mechanische

*) Techn.-chem. Jahrb. 1882, S. 398.

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Analyse der Erden. Hierbei fällt uns gleich die Eigentümlichkeit auf, die Herr *Peligot* mit vielen seiner Landsleute teilt, nämlich die, nichtfranzösische Leistungen möglichst unberücksichtigt zu lassen. Der beste aller Schlämmapparate, der *Schöne*'sche, ist nicht beschrieben, allerdings ein diesem ähnlicher, der als die Erfindung eines Herrn *Masure* angegeben wird. Wir könnten für unsere Aeusserung noch manche Belege aus andern Teilen des Werkes anführen, beschränken uns aber lieber auf die fernere Inhaltsangabe. Es folgt die Untersuchung des Wassers, der Mineralwässer, des Meerwassers, des Regen-, Cisternen-, Quellen-, Brunnen- und Flusswassers. Dann kommt ein Capitel über Dünger, Stallmist, Knochen, Guano, Natriumsalpeter, Phosphate. Weiter werden die Pflanzenaschen, die Getreidearten, Mehl und Brod abgehandelt, sodann die Futterstoffe, die Zucker, Rohr- und Rübenzucker, Glucose, Lävulose, Saccharin, sodann Oele, Milch, Butter, Kunstbutter und schliesslich Wein, Bier und Cider. Alle diese Abhandlungen enthalten nicht nur eine trockene Aufzählung der Operationen des analytischen Verfahrens, welches der Verf. für das beste hält, sondern auch Besprechungen der vorgekommenen und möglichen Verfälschungen, soweit solche in Betracht kommen können, deren Nachweis und Bestimmung, ferner Betrachtungen über die Wichtigkeit der einzelnen Artikel für den nationalökonomischen Gebrauch, die gesetzlichen Bestimmungen und deren Einfluss auf Production und Beschaffenheit und ähnliches. Dadurch wird der specielle Teil sehr lesenswert und enthält vieles, das auch für den deutschen Leser von Wichtigkeit ist.

Die bekannte Verlagshandlung hat dem Werke eine sehr schöne Ausstattung gegeben.

Pellet, *H.* et *G. Sencier*, la fabrication du sucre. T. 1: Historique; les principes sucrés; Saccharimétrie chimique et physique; Analyse des sols; les terres à betteraves, etc. 390 p. Paris, M. Pellet. 10 fr.

Poiré, *P.*, Leçons de chimie appliquée à l'industrie, à l'usage des industriels, etc. 8 édit. 499 p. Paris, Delagrave.

Powell, *H. J.*, *H. Chance* and *H. G. Harris*, the Principles of Glassmaking, together with Treatises on Crown and Sheet-Glass. 192 p. London, Bell & Sons. 3 sh. 6 d.

Precht, Die Salz-Industrie von Stassfurt und Umgegend. 8°. Stassfurt, Förster. ℳ 1.20.

Reis, *J.*, Bereitung der Brennerei-Kunsthefe. 8°. Wien, Hartleben. ℳ 1.50.

Renzone, *R.*, Analisi chimica e microscopica della urina normale e patologica. 8°. Napoli, Jovene & Co. 6 L.

Ridsdale, *C. H.*, Chemical Percentage Tables and Laboratory Calculation. Post-8°. 80 p. London, Lockwood. 3 sh. 6 d.

Robinet, *E.*, Les matières colorantes artificielles dans les vins. In-8°. 78 p. Epernay, impr. Bonnedame et fils.

Roger, *P.*, Simples notions de chimie agricole. In-12°. 100 p. Château-Goutier, Leclerc.

Roth, *E.*, Die Weinbereitung und Weinchemie in ihrer Theorie und Praxis. 2. Ausg. 2 Teile in 1 Bd. 8°. Heidelberg, Winter. ℳ 5.

Roussel, *E.*, La teinture par les matières colorantes dérivées de la houille. In-8°. 11 p. Lille, impr. Danel.

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Schaedler, *C.*, Die Technologie der Fette und Oele des Pflanzen- und Tierreiches. 8°. Berlin, Polytechnische Buchhandlung.

Schultz, *G.*, die Chemie des Steinkohlenteers mit besonderer Berücksichtigung der künstlichen organischen Farbstoffe. 2. (Schluss-) Abt. 8°. Braunschweig, Vieweg & Sohn. ℳ 20.

Dies bereits im vorigen Jahrgang signalisirte Werk*) liegt jetzt vollständig vor. Der Herr Verfasser hat eine ausführliche und im allgemeinen richtige Schilderung der Darstellung der künstlichen organischen Farbstoffe gegeben. Da kein Zweig der chemischen Technik so sehr mit der theoretischen Chemie zusammengewachsen ist, wie die Teerfarbstoff-Industrie, so hat der Herr Verfasser grossen Nachdruck auf die Discussion der chemischen Constitution der verschiedenen Verbindungen gelegt und dadurch ein sehr brauchbares Werk geschaffen, das wol geeignet ist, eine Grundlage für den weiteren Ausbau der Farbstoffchemie, dieses so schönen Teiles der chemischen Technik, zu bilden. Wir erwähnen besonders noch das letzte Capitel, welches Tabellen über das Verhalten der Teerfarbstoffe gegen Seide, Wolle und Baumwolle, ferner über die analytische Prüfung der Farbstoffe enthält.

Schwackhöfer, *Franz*, Lehrbuch der Landwirtschaftlich-chemischen Technologie mit besonderer Berücksichtigung der österreichischen Verhältnisse. Zum Gebrauche an landwirtschaftlichen und technischen Lehranstalten, für Landwirte, Industrielle, Steuerbeamte etc. Verfasst im Auftrage des hohen k. k. Ackerbau-Ministeriums. Erster Band, umfassend die Technologie der Wärme, des Wassers und der Kohlehydrate (Rübenzucker-, Stärke-, Dextrin-, und Stärkezucker-Fabrication). Mit 10 Tafeln und über 160 Illustrationen im Texte. Wien, Georg Paul Faesy. 8°. XX und 646 S.

Der ausgezeichnete Professor an der Wiener landwirtschaftlichen Hochschule hat dies Buch speciell für Unterrichtszwecke verfasst. Dabei lehnt er sich nicht an „berühmte Muster", sondern geht in durchaus originaler Weise seinen eigenen Weg. Auf demselben folgt man ihm gern. Bei jedem Schritt hat man die Ueberzeugung, einen Führer zu haben, der sein Gebiet gründlich kennt und in einfach klarem Vortrage das Wissenswerte darüber mitzuteilen versteht. Sehr zu loben ist es, dass der Technologie der Wärme ein grosser Raum an erster Stelle gegeben ist; die Wärmeerzeugung ist ja eine der Grundlagen einer jeden chemischen Industrie und nimmt im Budget einer Fabrik einen wichtigen, oft den wichtigsten Platz ein. Es folgt die Technologie des Wassers, ebenfalls für jedes chemische Gewerbe von fundamentaler Bedeutung. Der Rest des Bandes ist der Rübenzucker-, Stärke-, Dextrin- und Stärkezucker-Fabrikation gewidmet. Es sind hierbei die österreichischen Verhältnisse, besonders auch bei Erläuterung der Steuermodalitäten und deren Einfluss auf die Fabrication, in erster Linie berücksichtigt. Da aber die österreichische (spec. böhmische) Rübenzuckerindustrie einen so hohen Grad der Vollendung erreicht hat, so wird auch der Nicht-Oesterreicher dies Capitel mit Nutzen studiren. Hier und da in der Zuckerindustrie und in der Stärkefabrikation hätten wir etwas grössere Vollständigkeit gewünscht, die herbeizuführen dem Herrn Verfasser durch grössere Benutzung der Patentlitteratur leicht gewesen sein würde; im ganzen dürfen wir aber mit unserem aufrichtigen Beifall nicht zurückhalten, der sich besonders auch

*) Techn.-chem. Jahrb. 1883, S. 460.

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auf die schönen, meist originalen Zeichnungen erstreckt, sowie auf die elegante Ausstattung, die der Herr Verleger dem Buche gegeben hat.

Karl Seubert und *Moritz Seubert*, Handbuch der allgemeinen Warenkunde für das Selbststudium, wie für den öffentlichen Unterricht. Zweite Auflage, bearbeitet von *Karl Seubert*. Stuttgart, Jul. Maier, 1883. 2 Bde. 8°. 453 und 599 S.

Herr *K. Seubert* hat es unternommen, das verdienstvolle Werk der beiden verstorbenen Verfasser in neuer Auflage dem jetzigen Stand der Wissenschaften und des Handels anzupassen. *Seubert*'s Warenkunde ist nicht ausschliesslich ein Nachschlagebuch, es ist vor allem ein gut geordnetes Lehrbuch. Deshalb ist dem Stoffe nicht die gebräuchliche alphabetische Anordnung gegeben, sondern dasselbe ist in ein übersichtliches System gebracht. Der erste Band des Buches enthält einen allgemeinen Teil, in welchem die physikalischen und chemischen Eigenschaften der Waren, soweit sie zu deren Erkennung dienen können, im Zusammenhang abgehandelt werden, und sodann die Beschreibung der aus dem Mineralreiche stammenden Waren. Diese sind in zehn Gruppen untergebracht. Der zweite Band enthält in je sieben Gruppen die Beschreibung der Waren aus dem Tierreiche und Pflanzenreiche. Hier sind die Nahrungs- und Genussmittel in wünschenswertester Ausführlichkeit behandelt behandelt, wie denn überhaupt der zweite Band uns besser gelungen zu sein scheint, als der zweite. Dieser steht in technologischer Beziehung nicht immer auf der Höhe der Wissenschaft. Das Capitel über Eisen erscheint uns ganz unzulänglich. Die alte nicht mehr aufrecht zu haltende Einteilung in Roheisen, Schmiedeisen, Stahl ist beibehalten; von der neueren Nomenclatur und den entsprechenden Eisenarten erfahren wir nichts, sogar des Entphosphorungsprocesses wird mit keinem Worte gedacht. Beim Nickel hätte das jetzt so vielfach verwendete *Fleitmann*'sche Nickelblech erwähnt werden müssen. Statt thioschwefelsaures Natrium finden wir unterschwefligsaures Natrium, während unter den englischen Bezeichnungen „sodic thiosulphate" figurirt. Sonst sind Synonyme, sowie englische und französische, stellenweise auch anderssprachige Uebersetzungen in grosser Fülle angegeben. Der sprachliche Ausdruck könnte oft wol etwas sorgfältiger sein; das immer wiederkehrende: die Darstellung „geschieht", die Behandlung „geschieht", klingt für die meisten Ohren nicht schön. Bei alledem sind wir überzeugt, dass das Buch in den Kreisen, an die es sich richtet, grossen Nutzen stiften wird, dass es sogar wegen der Fülle und einfachen Darbietung des Stoffes ein Familienbuch zu werden verdient. Sehr ausführliche Register erleichtern den Gebrauch als Handbuch.

Sibson, A., Agricultural Chemistry. With a Preface by Dr. *Augustus Voelcker*. New edit. 12°. 278 p. London, Routledge. sh. 1,6.

Smith, D., The English Dyer. With instructions showing how to dye 150 shades of cotton yarns in the hank, 50 shades of cotton wool, 150 shades of worsted yarns, 100 shades of animal wool, and 50 shades of silk in the skein etc. etc. 8°. Manchester. (London, Simpkin). sh. 84.

Stork, W., Die Tierstoffe. Die Haut, Haare, Wolle, Seide, Blut, Fleisch, Galle etc., ihre Gewinnung und Verwertung. 8°. Halle, Knapp. ℳ 3.

Thomas, A., Manuel d'alcoométrie, tables et formules pour servir au calcul des mélanges d'eaux-de-vie à tous les degrés. Lille, impr. Danel.

Toifel, W F., Handbuch der Chemigraghie, Hochätzung in Zink für Buchdruck mittelst Umdruck von Autographien und Photogrammen und di-

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recter Copirung oder Radirung des Bildes auf die Platte. 8°. Wien. Hartleben. *M* 3,25.

Tscheuschner, E., Handbuch der Metalldecorirung. 5. Aufl. von *Gräger*'s Handbuch. 8°. Weimar, B. F. Voigt. *M* 5.

Ville, G., on Artificial Manures: their Chemical Selection and Scientific Application to Agriculture. Translated and edited by *William Crookes*. 2. édit. 486 p. London, Longmans. sh. 21.

Vogel, H. W., Die Fortschritte der Photographie seit dem Jahre 1879. Berlin, Rob. Oppenheim. 1883. 8°. 176 S.

Der rühmlichst bekannte Verfasser hat in diesem Buche die Fortschritte der Photographie innerhalb der letzten vier Jahre in übersichtlicher Weise geordnet. Wenn man bedenkt, dass in diesem Zeitraum vor allem die Entwickelung der Emulsionsphotographie, sodann die Anwendung des elektrischen Lichtes, die Entstehung und Weiterausbildung des Platinprocesses und verschiedener Lichtpausverfahren fällt, so wird man einsehen, dass das Buch eine grosse Fülle höchst wichtiger und interessanter Thatsachen bietet. Dieselben sind hier von einem der ausgezeichnetsten Fachmänner dargestellt, der bei aller Wissenschaftlichkeit es doch versteht, gemeinverständlich zu schreiben, wie besonders die ersten vier Capitel, Physikalische Lichtwirkungen, Chemische Lichtwirkungen, Photographische Chemie und Photographische Optik beweisen. Ein Anhangscapitel, Photographie für Amateure, enthält viele wertvolle Ratschläge, die besonders die Naturforscher jeder Richtung veranlassen mögen, dies herrliche Hülfsmittel der Photographie öfter zu benutzen, als es bisher geschieht. Das Buch ist mit guten Illustrationen ausgestattet; es bildet eine unentbehrliche Ergänzung zu *Vogel*'s Lehrbuch der Photographie.

Waarenkunde, Allgemeine und Rohstofflehre. I. Band. Die Stärke- und Mahlproducte von ***Franz von Höhnel.*** Kassel und Berlin, Theodor Fischer. 1882. 8°. 120 S. *M* 2,40.

Die Verlagshandlung will unter Leitung des Herrn ***F. H. Haenlein*** ein Werk über Waarenkunde veröffentlichen derart, dass der Inhalt desselben auf einzelne Bändchen verteilt wird, von denen jedes eine zusammengehörige Gruppe von Stoffen enthält und ein in sich abgeschlossenes Ganzes bildet. Auf diese Weise, so scheint es, wird der betreffende Gegenstand in etwas grösserer Ausführlichkeit behandelt werden können, als es in den trefflichen encyklopädischen Werken von *Merck*, *Seubert* u. a. der Fall ist. Die Bearbeitung der Gruppen ist in die Hände bewährter Gelehrter und Fachleute gelegt. Das erste Bändchen handelt von der Stärke und den Mahlproducten. Der Verfasser hat es verstanden, Vollständigkeit und strenge Wissenschaftlichkeit mit einer anspruchslosen Darstellung zu vereinigen, so dass die Schrift für die Praktiker in hohem Grade geeignet ist. Der Inhalt betrifft: die Rohstoffe der Stärke; die Eigenschaften der Stärke; die wichtigsten Stärkesorten des Handels; Prüfung und Wertbestimmung der Stärkearten; das Inulin; die Mehle und Mahlproducte; Mikroskopie der Mahlproducte; Untersuchung des Mehls und der Mahlproducte. Die letzteren Capitel enthalten manches Neue, besonders auch neu nach der Natur gezeichnete mikroskopische Darstellungen. Wir wünschen der Allgemeinen Waarenkunde auf dem beschrittenen Wege in etwas raschem Tempo fortzuschreiten.

Weiss, J., die Galvanoplastik. Ausführliche praktische Darstellung des galvanoplastischen Verfahrens in allen seinen Einzelheiten. 2. Aufl. 8°. Wien, Hartleben. *M* 3,25.

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Wipplinger, S., die Keramik oder die Fabrikation von Töpfergeschirr, Steingut, Fayence, Steinzeug, Terralith etc. 8°. Wien, Hartleben. *M* 4,50.

IV. Mineralogie, Geologie, Botanik.

Braconnier, A., Description géologique et agronomique des terrains de Meurthe-et-Moselle. 444 p. Paris, Savy.

Burnham, L. M., Limestones and Marbles; their History and Uses. 8°. Boston. sh. 36.

Cohen, E., Sammlung von Mikrophotographien zur Veranschaulichung der mikroskopischen Struktur von Mineralien und Gesteinen. 7. u. 8. Lfg. 4°. Stuttgart, Schweizerbart. In Mappe *M* 16.

Dana, J. D., and *G. J. Brush*, a System of Mineralogy comprising the most recent Discoveries. 5 edit., with upwards of 600 woodcuts. Roy-8°. 1072 p. London, Trübner. sh. 42.

Dechen, H. v., Geologische Karte der Rheinprovinz und der Provinz Westphalen. 1 : 80 000. Sect. 24. Chromolith. Fol. Berlin, Schropp. *M* 3.

Delage, A., Eléments d'histoire naturelle des pierres et des terrains. In-12°. 173 p. Paris, Hachette et Co. Fr. 2.

Delattre, Charles, Étude sur les gisements français de phosphate de chaux. Note sur la décomposition du phosphate bicalcique par l'eau. In-8°. 80 p. Paris, impr. Davy.

Ernst, O. v, Die Montanindustrie Italiens. 8°. Wien, Manz. *M* 2.

Excursions-Karte, Berg- und hüttenmännische, für die Umgegend von Aachen 1 : 80 000. Chromolith. Fol. Aachen, Jacobi. *M* 1.

Flötz-Karte, von dem Saarbrücker Steinkohlen. District. 1 : 50 000. Mit Profilkarte. Aubeldruck. Fol. Saarbrücken, Klingebeil. *M* 1,70.

F. Fouqué und *Michel Lévy*, Synthèse des minéraux et des roches. Paris, G. Masson, 1883. 8°. 423 S.

Die Herren Verf. sind seit langem weit bekannt durch ihre ausgezeichneten Arbeiten in der synthetischen Mineralogie. Sie haben durch mikroskopische und andere Beobachtungen die absolute Uebereinstimmung in Zusammensetzung und Structur vieler von ihnen im Laboratorium dargestellten und der natürlichen Mineralien festgestellt. Sie haben durch die Synthese der Feldspathe, des Augits, des Leucits der Geologie unschätzbare Dienste geleistet, ja es ist ihnen gelungen, typische Gesteine, Basalt und andere, die sich in nichts von den natürlichen unterscheiden, künstlich darzustellen. Diese ausgezeichneten Forscher haben in dem vorliegenden Werke alle bis jetzt ausgeführten Mineralsynthesen und Vorkommen künstlicher Entstehung von Mineralien gesammelt. Durch das Studium dieser Arbeiten von *Becquerel, Daubrée, Debray, Ste.-Claire-Deville, Ebelmen, Fouqué* und *Lévy, Fremy, Mitscherlich, Wöhler* u. s. w. wird man sich recht bewusst, dass Mineralogie, Petrographie, Geologie von heutzutage wirklich inductive Wissenschaften sind, die auf physikalischer und chemischer, im Laboratorium controlirbarer Basis beruhen. Das Werk stellt sich würdig den berühmten Arbeiten über Experimental-Geologie von *A. Daubrée**) zur Seite. Beim Durchblättern fällt uns

*) *A. Daubrée.* Synthetische Studien der Experimental-Geologie. [Deutsch von *Ad. Gurlt.* Braunschweig, Vieweg, 1880.

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auf, dass beim Gay-Lussit das von Herrn *Reidemeister* in den roten Laugen der Sodafabrikation entdeckte Vorkommen derselben und die Untersuchung *Rammelsberg*'s*) darüber hätte erwähnt werden müssen.

Frantz, W. A., und *J. Dannenberg,* Hüttenmännisches Wörterbuch. 1. Lfg. 8°. Leipzig, Felix. ℳ 2,50.

Frazer, P., Mémoire sur la géologie à l'usage de l'enseignement secondaire. 6 édit. Paris, V. Belin et fils.

Galloway, R. L., A History of Coal Mining in Great Britain. 182 p. London, Macmillan. sh. 7,6.

Green, A. H., Geology. Part. 1: Physical Geology. 8°, 752 p. London, Rivingtons. sh. 21.

Gruner, L., Bassin houiller de la Loire 1 et 2 parties. Paris, impr. Quantin.

Gruner, H., Die Bedeutung der geologisch-agronomischen Bodenkartirung und die beste Methode, sie für die Praxis verwertbar zu machen. 8°. Berlin, Parey, ℳ 0,50.

Hoppe, O., Die Bergwerke, Aufbereitungs-Anstalten und Hütten, sowie die technisch-wissenschaftlichen Anstalten, Wohlfahrts-Einrichtungen etc. im Ober- und Unter-Harz. 8°. Clausthal, Grosse. ℳ 6.

Jaarboek van het mynwezen in Nederlandsch Oost-Jndië. 11 jaargang, 1882. Amsterdam, Stemler. fl. 5.

Karte über die Production, Consumtion und Circulation der mineralogischen Brennstoffe in Preussen, während des Jahres 1881. Herausgegeben im königlich preussischen Ministerium der öffentlichen Arbeiten. 1: 1,200,000. 2 Blatt Chromolith. Fol. Mit Text in 4°. Berlin, Schropp. ℳ 6.

Kinkelin, F., Kurzer Abriss der Mineralogie, einschliesslich der wichtigsten geologischen Erscheinungen. 8°. Wiesbaden, Bergmann. ℳ 1,60.

Lock, A. G., Gold: its occurance and extraction. Embracing the geographical and geological distribution, and the mineralogical characters of goldbearing rocks, the peculiar features and modes of working shallow places, rivers, and deepheads, hydraulicing, the reduction and separation of auriferous ores containing other metals, a bibliography of the subject, and a glossary of english and foreign technical terms. Roy-8°, 1240 p. London, Spon. sh. 52,6.

Lorenz v. Liburnau, Die geologischen Verhältnisse von Grund und Boden. Für die Bedürfnisse der Land und Forstwirte. 8°. Wien, Braumüller. ℳ 8.

Malaise, C., Manuel de minéralogie pratique. 2 édit. In 12°, IV—394 p. Bruxelles. fr. 5.

Meunier, Stan., Histoire naturelle des pierres et des terrains. Géologie. Paris, Masson. fr. 2,25.

Petzholdt, A., Beitrag zur Kenntnis der Steinkohlenbildung, nebst Kritik des Werkes von *P. F. Reinsch*: Neue Untersuchungen über die Mikro-

*) Techn.-chem. Jahrb. 1882, S. 111.

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structur der Steinkohle des Carbon, der Dyas und Trias. 8°. Leipzig, T. O. Weigel. ℳ 1,50.

Pieler, F., Ueber einfache Methoden zur Untersuchung der Grubenwetter. Mit 5 Illustr. gr. 8°. Aachen, Barth. ℳ 1.

Rammelsberg, C. F., Elemente der Krystallographie für Chemiker. 8°. Berlin, Habel. ℳ 5.

Reinsch, P. F., Mikrophotographien über Structurverhältnisse und Zusammensetzung der Steinkohle des Carbon, entnommen von mikroskopischen Durchschnitten der Steinkohle. 4°. Mit 13 Tafeln in Mappe. Leipzig, T. O: Weigel. ℳ 60.

Saporta, G. de, La formation de la houille. Paris, impr. Quantin.

Sievers, J., Uebersichtskarte der Berg- und Hüttenwerke im Oberbergamtsbezirk Dortmund. 1:80,000. 6. Aufl. Chromolith. Fol. Iserlohn, Baedecker. ℳ 4,50.

Specialkarte, geologische, des Königreichs Sachsen. Herausgegeben vom königlichen Finanzministerium. Bearbeitet unter der Leitung von Herrn *Credner*. Sect. 148. Chromolith. Fol. Mit Erläuterungen in 8°. Leipzig, Engelmann. ℳ. 3.

Inhalt: Kupferberg (Haumer-Unterwiesenthal) von *A. Sauer*.

Standfest, F., Leitfaden für den mineralogischen Unterricht an den oberen Classen der Mittelschulen. 8°. Graz, Leuschner & Lubensky. ℳ 1.40.

Sykyta, W., Das Holz, dessen Benennungen, Eigenschaften, Krankheiten und Fehler. 8°, Prag, Dominicus. ℳ 9,60.

Vuillemain, Le bassin houiller du Pas-de-Calais, histoire de la recherche de la découverte et de l'exploitation de la houille dans ce nouveau bassin. T. 2. In-8°, 410 p. et 21 pl. Lille, impr. Danel.

V. Verschiedenes.

Brelow, G., O. Dammer u. *E. Hoyer*, Technologisches Lexikon. 8°. Leipzig, Bibl. Institut.

Eger, G., Technologisches Wörterbuch in englischer und deutscher Sprache. 1. Tl. Englisch-Deutsch, herausgegeben von *O. Brandes*. 8°. Braunschweig. Vieweg & Sohn. ℳ 9.

Garnier, E., Histoire de la céramique, poteries, faiences et porcelaines chez tous les peuples depuis les temps les plus anciens jusqu'à nos jours. 2 édit. 568 p. Tours, Mame et fils.

History of Paper: its Genesis and its Revelations. Origin and Manufacture Utility and Commercial Value. 12°. Holyoke. Mass. (London). sh. 10,6.

Karmarsch u. *Heeren's*, Technisches Wörterbuch. 3. Aufl. bearbeitet von *Kick* u. *Gintl*. 8°. Prag, Haase. à Lfg. ℳ 2.

Kraft, M., Grundriss der mechanischen Technologie für Gewerbe und Industrieschulen. Nach *E. Hoyer's* Lehrbuch der vergleichenden mechanischen Technologie bearbeitet. 2 Abt. 8°. Wiesbaden, Kreidel. ℳ 4.

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Künstle, G., Kohlenstoff-Skizzen, ein organisch-chemisches hohes Lied. 2. Aufl. 8°. München, Theod. Ackermann. ℳ 1,20.

Lunge, G., Das Verbot der Phosphorzündhölzchen in der Schweiz und dessen Wiederaufhebung. 8°. Zürich, Schmidt. ℳ 1,20.

Morgan, C. L., Water and its Teachings in Chemistry, Physics and Physiography: a suggestive handbook. 18°. 206 p. London, Stanford. sh. 2,6.

Pékar, E., Weizen und Mehl unserer Erde vom Gesichtspunkt der Wissenschaft, des Consumenten, des Müllers und des Producenten. 8°. Pest. Grill. ℳ 4.

Tolhausen, A., und *L. Tolhausen*, Dictionnaire technologique dans les langues française, anglaise et allemande. Français - allemand - anglais. 3 édit. Augmentée d'un grand supplément. 12°. Leipzig, B. Tauchnitz. ℳ 10.

Tyndall und *Pasteur*, Les microbes organisés, leur rôle dans la fermentation, la putréfaction et la contagion: mémoires. 236 p. Paris. Gauthier-Villars.

Ule's, O., Warum und Weil. Chemischer Teil von *F. Langhoff*. 2. Aufl. 8°. Berlin, Klemann. ℳ 3,50, cart. ℳ 4.

Die Naturgeschichte des *Cajus Plinius Secundus*. Ins Deutsche übersetzt und mit Anmerkungen versehen von *G. C. Wittstein*. Leipzig, Gressner und Schramm. 1882. 3 Bde.

Die Naturgeschichte des *Plinius* enthält so ziemlich alles, was seine Zeit von naturwissenschaftlichen Dingen wusste und zu wissen vermeinte. Daher sind diese Bücher, die von der umfassenden Gelehrsamkeit und dem staunenswerten Fleiss ihres Verfassers ruhmvolles Zeugnis ablegen, für uns von unvergleichlichem historischen Wert. Neben manchen Wahrheiten, die oft ganz überraschend sind und fast modern wissenschaftlich klingen, findet sich eine grosse Zahl von Fabeln, deren Entstehung oft unbegreiflich erscheint. Kritik, Experiment, Induction — etwas Derartiges finden wir bei *Plinius* nicht: höchstens dass er einmal über den Bericht eines andern Zweifel laut werden lässt. Das encyklopädische Werk des *Plinius* handelt in 38 Büchern nach der Dedication an den Kaiser Titus Vespasianus von der Welt und den Elementen, von der Lage und Grösse der Länder, Meere, Städte, Häfen, Berge, Flüsse und den Völkern, von der Entstehung und Beschaffenheit des Menschen und von der Erfindung der Künste, von den Landtieren, von den Wassertieren, von den Vögeln, von den Insecten, von den Bäumen, den Salben und Balsamen, von dem Weinstock und dem Wein, von den Obstbäumen, von den wilden Bäumen, von den angepflanzten Bäumen, von den Feldfrüchten, von dem Lein und der Cultur der Gartengewächse, von Arzneimitteln aus Gartengewächsen, von den Blumen und Kränzen, von dem Ansehen und Werte der Kräuter und Feldfrüchte, von Arzneimitteln aus cultivirten Bäumen, aus wilden Bäumen, von der Beschaffenheit der wildwachsenden Kräuter, von den übrigen Kräutern und ihrer arzneilichen Anwendung, von Krankheiten, von Arzneimitteln aus Tieren, von Arzneimitteln von dem Wasser, von Arzneimitteln aus Wassertieren, von den Metallen und Erzen, von der Malerei und den Farben, von den Steinen, von den Edelsteinen.

Das merkwürdige Buch ist schon öfter in das Deutsche übertragen worden, aber keine dieser Uebersetzungen genügt weder in sprachlicher, noch in sachlicher Beziehung den heutigen Ansprüchen. Niemand war berufener, eine nach jeder Hinsicht vollkommene Uebersetzung zu schreiben, als *C. G.*

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Wittstein, der neben umfassenden naturwissenschaftlichen Kenntnissen eine aussergewöhnlich tiefe philologische Gelehrsamkeit besitzt. So tritt uns denn hier voller Lebendigkeit die naturwissenschaftliche Cultur einer hochentwickelten untergegangenen Nation entgegen, und um so leichter wird das Verständnis derselben uns zugänglich gemacht, als Herr *Wittstein* zahlreiche erläuternde Anmerkungen hinzugefügt hat. Die Benutzung des Buches wird durch ausführliche Verzeichnisse bequem gemacht, welche die von *Plinius* benutzten Autoren (516 an der Zahl) und alphabetische Register über die auf Anthropologie, bildende Künste, Botanik, Geographie, Kosmographie, Landwirtschaft, Medicin, Mineralogie und Zoologie bezüglichen Angaben enthalten. Jeder, der sich für die geschichtliche Entwickelung der Naturwissenschaft interessirt — und wer thäte es nicht? — wird Herrn *Wittstein* dankbar sein für diese ausgezeichnete Uebertragung des ewig lebendigen Werkes, das der „Kosmos" des römischen Altertums war, und wird auch einstimmen in den Ruf, mit dem *Plinius* sein grosses Werk schliesst: Sei mir gegrüsst, Natur, du Mutter aller Dinge! Wir wünschen zum Schluss unseren heutigen naturwissenschaftlichen Autoren, dass ihre Bücher eine ebenso lange Lebensdauer haben mögen, wie die Historia naturalis des Collegen *Cajus Plinius Secundus*.

Zabel & Co., Verzeichnis der Rübenzucker-Fabriken, Raffinerien, Candis-Fabriken etc. des Zollvereins, Oesterreichs und Hollands. Ausg. 1882/83. 8°. Quedlinburg, Huch. *M* 4.

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